Research Note 84-114

COMMAND CONTROL GROUP BEHAVIORS
FINAL REPORT - OBJECTIVE 2
COMMAND CONTROL TRAINING WITH SIMULATIONS

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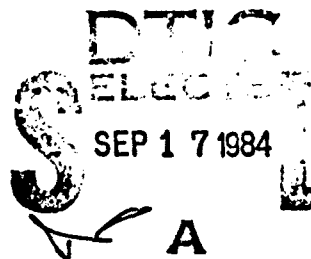Research Institute for the Behavioral and Social Sciences

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report provides the results of the first year's research of a three year effort to develop strategies and a planning guide for use of extant battle simulations in an integrated fashion to achieve maximum training benefit for resources expended. It describes the data collection effort, the development of a diagnostic tool, and an assessment of simulation suitability. A number of findings and conclusions are stated.

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COMMAND CONTROL GROUP BEHAVIORS - OBJECTIVE 2
COMMAND CONTROL TRAINING WITH SIMULATIONS

BRIEF

This volume describes the results of the first year's work on the second objective of the study, COMMAND GROUP BEHAVIORS. Two companion volumes describe the work done on the other two objectives.

Purpose:

The purpose of Objective 2 is to develop strategies and a planning guide for use of extant battle simulations in an integrated fashion to achieve the maximum training benefit for resources expended based on unit and echelon specific training needs.

First Year Goals:

The goals of the first year's effort in support of Objective 2 are:

- Initiation of diagnostics development through analysis of the internal data flow within the command/staff grroup elements.

- Analysis of extant simulations to determine adequacy of scope of coverage of ARTEP standards.

- Analysis of extant simulations to determine adequacy of data collection and reduction with respect to ARTEP standards.

- Initial formulation of the "Command Group Training Packet."

Method:

The first year goals were reached by means of the following actions:

- A work plan was developed and submitted.

- A literature search of documents pertinent to the training of command control groups was conducted including ARTEPs, FMs, technical reports, and training circulars. These were reviewed: to identify the general training requirements, to utilize pertinent information in earlier studies, and to determine the availability of documentation directly useful to commanders and senior staff officers for training of their own staff.

- A total of four field trips were made by the Objective 2 study team. Two were made to Fort Leavenworth to obtain background information on simulation activities and usage, ARTEPs, and other related Army activities such as C^2SPR and CATTS. Two other CONUS posts were visited to get information on field usage of simulations both from operators and users.

- The development of diagnostics to facilitate identification of individual training deficiencies was initiated as follows:

  - A common reference numbering system for ARTEP tasks and subtasks was developed.

  - The critical elements contained in ARTEP tasks and subtasks were identified.

  - A model of command control group behavior with respect to processing information was postulated, the required skills identified, and a data collection and reduction technique developed to validate the model as part of the Objective 1 effort.

  - A preliminary set of standards of performance for ARTEP tasks was developed.

  - The means by which ARTEP performance deficiencies can be related to individual training deficiencies was illustrated by means of "diagnostic segments."

- A preliminary evaluation of simulation suitability for use as C^2 group training devices was accomplished.

- The scope of extant simulations with reference to ARTEP tasks and standards was examined.

Conclusions:

- There exists a need for common format, functional documentation for all extant simulations.

- A single methodology for all simulations from corps to battalion level is highly desirable.

- Extant simulations will continue to be used for purposes other than command and staff training; thus, there is a need to provide guidance as to the impact of simulation limitations for such applications.

- Guidelines are needed for use of ARTEPs in conjunction with extant simulations.

- There is a need for development of specific guidance relating to feedback techniques and procedures.

- Given ingenuity and careful preparation by exercise directors, the scope of extant simulations appears generally adequate.

- Computer support acceptance will increase at local levels as junior officers familiar with simulations and computer technology advance in rank.

- There is a need for guidance for training of staff elements prior to their participation in simulation play.

- Simulation utility can be improved by increasing emphasis on the player planning process preceding actual execution.

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SECTION I

INTRODUCTION

1.1 PURPOSE

The purpose of this research is to develop strategies and guidance for the use of extant battle simulations in an integrated fashion so that units in the field will achieve the maximum training benefit for resources expended based on unit and echelon specific training needs, objectives, and situational constraints. Training strategies pertain to use of the simulations concurrently or in some sequential fashion to achieve training objectives.

Training guidance should reflect how each of the simulations being considered can be best used to train corps through battalion commanders and their staffs to achieve ARTEP standards. Guidance is needed for:

- Establishing training objectives

- Determining criteria to be used to select an appropriate simulation(s)

- Developing methods and procedures for conducting the exercise with emphasis on performance recording and reduction capabilities

- Feeding back performance data to personnel being trained (players), and

- Developing remedial training options.

In developing strategies and guidance it is necessary to consider the following simulations:

- WAR EAGLE at the corps level

- FIRST BATTLE at the division level

- CAMMS and PEGASUS at the brigade and battalion levels

- BATTLE and DUNN-KEMPF as they relate to training battalion and above commanders and staff in tactics, terrain use, and weapons effects knowledge.

A brief description of each listed simulation is found at Appendix B.

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Training guidance should reflect how each of the above mentioned simulations, as they are now structured, can be best used in training corps through battalion commanders and their staffs to achieve ARTEP standards; and appropriate training strategies for the use of all the simulations should articulate how they could be used concurrently or in some sequential fashion to achieve given training objectives.

In the process of acquiring the data necessary to develop the guidelines outlined above, it will be possible to identify modifications for each simulation which would allow them to:

- Be more effective training vehicles for some tasks for which they now possess a limited training capability, or

- Provide a training medium for tasks for which they do not now possess the capability.

1.2   SCOPE AND GOALS

1.2.1   Scope

Simulations to be considered are the following:

Echelon	Manual Simulations	Computer Supported Simulations
Corps	WAR EAGLE	---
Division	FIRST BATTLE	
Brigade	PEGASUS	CAMMS
Battalion	PEGASUS	CAMMS

CAMMS II, now in development, is being monitored throughout the program, with review and comment as appropriate. (This simulation will be applicable at division, brigade and battalion levels.) DUNN-KEMPF was examined as it relates to training battalion and above commanders and staffs in tactics, terrain use and weapon effects.

It is recognized that the term "simulation" can encompass the total combination of an individual game/simulation, player and controller personnel, associated equipment, processes and conditions.

For purposes of the firs. year's work, however, "simulation" will be used in its narrower sense, i.e., a general identifier of the simulations listed above in their role as training "vehicles." This definition will be extended in later phases of the work as appropriate relationships are established.

In the first year, staff elements to be addressed will consist of the coordinating staff (omitting G-5), the FSE, ADE, and the NBC elements of the special staff. Additional elements will be added in Year Two to the extent their relationships are deemed necessary and appropriate.

1.2.2   Goals

The goals of the initial year of work are:

o   Initiation of diagnostics development through
     analysis of the internal data flow within the
     command/staff group elements,

●   Analysis of extant simulations to determine
     adequacy of scope of coverage of ARTEP standards,

●   Analysis of extant simulations to determine
     adequacy of data collection and reduction with
     respect to ARTEP standards, and

●   Initial formulation of the "Command Group Training
     Packet."

Goals for the full three-year program, by year, are shown at Table 1-1.

1.2.3   Overview -- First Year

The first year's work, shown schematically in Figure 1-1, began with a data collection effort consisting of a literature review and a survey to obtain developer and user consensus with regard to extant simulations. Following establishment of this foundation a three-track research effort was carried out. The logical basis for structuring the internal information flow within the command and staff

TABLE 1-1. OBJECTIVE 2 GOALS

Goals

YEAR 1	YEAR 2	YEAR 3
1. Initiation of diagnostics development through analysis of the internal data flow within the command/staff group elements.	1. Complete diagnostics development by structuring fault tree and preparing troubleshooting procedure.	1. Complete CGTP
2. Analysis of extant simulations to determine adequacy of scope of coverage of ARTEP standards.	2. Completion of simulation review and incorporation of Objective 1 lessons learned.	2. Development of new/improved training simulations
3. Analysis of extant simulations to determine adequacy of data collection and reduction with respect to ARTEP standards.	3. Validation of work done on simulations.	3. Addition of MCS into tools provided.
4. Initial formulation of the "Command Group Training Packet."	4. Development of alternatives and recommendations of incorporation of ADP (ECS2).	4. Automation of data collection and reduction.
		5. Field Trials (?)

(Dependant upon output of Y 1, 2 and as directed by sponsor.) [applies to Year 3 items 2–5]

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                    │ RESEARCH PLAN   │
                    │             ①   │
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                             │
                             ▼
              ┌──────────────────────────────┐
              │      DATA COLLECTION         │
              │     REFERENCES/ARTEPS/       │
              │   SIMULATIONS & INTERVIEWS   │
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   ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
   │  SIMULATION  │      │  CONCLUSION  │      │  SIMULATION  │
   │    SCOPE     │─────▶│      &       │◀─────│ SUITABILITY  │
   │          ④   │      │RECOMMENDATIONS│     │          ⑤   │
   └──────────────┘      │           ⑥  │      └──────────────┘
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                    ┌─────────────────┐
                    │    TRAINING     │
                    │    PACKET       │
                    │    OUTLINE      │
                    │             ⑦   │
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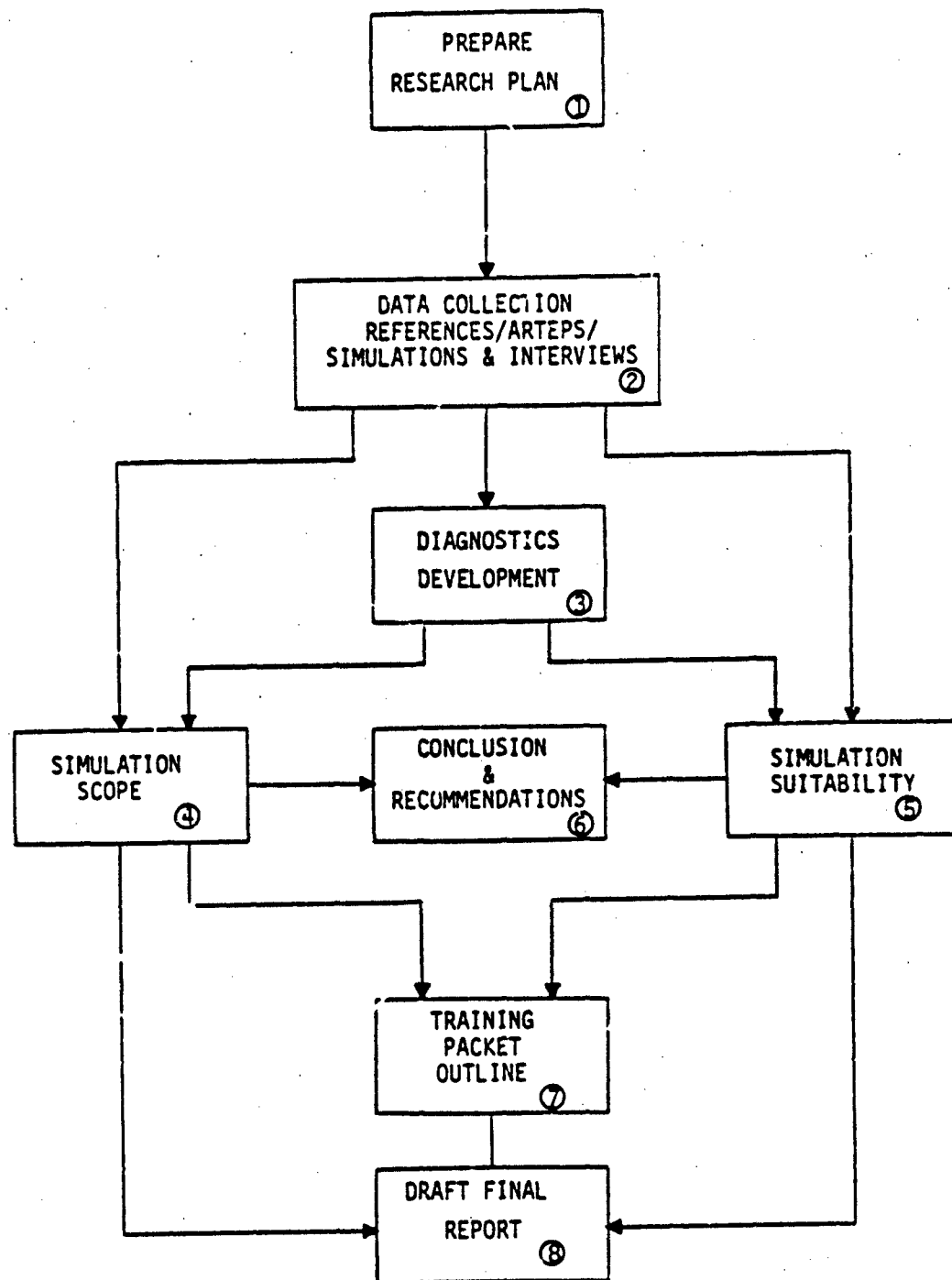
FIGURE 1-1. RESEARCH PLAN OBJECTIVE 2, COMMAND GROUP BEHAVIOR

elements was established as a basis for the construction of the diagnostic fault tree in the second year. Concurrently with that effort, analysis of the scope and prescribed operation of extant simulations in comparison with ARTEP prescribed standards for tasks and sub-tasks was carried out. Finally, the outline for the Command Group Training Packet was formulated and a preliminary draft incorporating the results of the first year's research was prepared.

Essential to proceeding with an analysis of the interrelationships betwen ARTEPs, staff actions and processes and simulations as will be developed in the individual tasks below is an explicit derivation of the linkages involved. These are portrayed in Figure 1-2 (but may be modified as a result of future research). Definitions for concepts developed by SAI (asterisked items) are found at Section 1.5.

1.2.4   Relationship to Objectives 1 and 3

The research and analysis associated with Objective 2 proceeded independently of those associated with Objectives 1 and 3. However, information was interchanged as appropriate. It is pertinent here to examine the relationship between Objective 2 and Objectives 1 and 3 in order to determine how the results obtained from Objectives 1 and 3 will be integrated into the second- and third-year research efforts in support of Objective 2.

A purpose of Objective 1 is the identification of those team and individual behaviors and decision-making processes (both procedural and non-procedural) constituting effective command and control. The insights gained from Objective 1 will provide useful tools for the development of the Objective 2 diagnostic package. For example, if it can be determined which command/control behaviors and processes are most and least effective, then a set of guidelines can be developed which can be used to evaluate the performance of a commander and staff group during a particular training exercise. The diagnostics are currently envisioned as comprising a set of diagnostic segments which show the structure of and elements associated with the performance of a given ARTEP task or subtask. These segments can be viewed as trees whereby the staff actions associated with a given task can be traced and performance deficiencies can be identified. The insights gained from Objective 1 can be applied to this concept in order to point out which behaviors/processes contributed to the identified performance deficiency, thus facilitating the establishment of training requirements.

Whereas the results obtained from Objective 1 can be applied to the research associated with Objective 2, Objective 2 will in turn facilitate the research entailed in Objective 3. The purpose of Objective 3 is to develop a strategy for ensuring an effective and smooth implementation of ADP in support of tactical command/control.

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STAFF
RESPONSIBILITIES
(FM 101-5)

ARTEP
TASKS/SUBTASKS

CRITICAL
ELEMENTS*

STAFF
ACTIONS*

INFORMATION
PROCESSES*

EXTANT
SIMULATIONS

SIMULATION
SCOPE

EMPLOYMENT
AND
MODIFICATIONS

ARTEP
STANDARDS

PERFORMANCE
DEFICIENCIES*

INDICATORS*

DIAGNOSTICS*
(DIAGNOSTIC
SEGMENT
DEVELOPMENT)

COMMAND GROUP
TRAINING PACKET
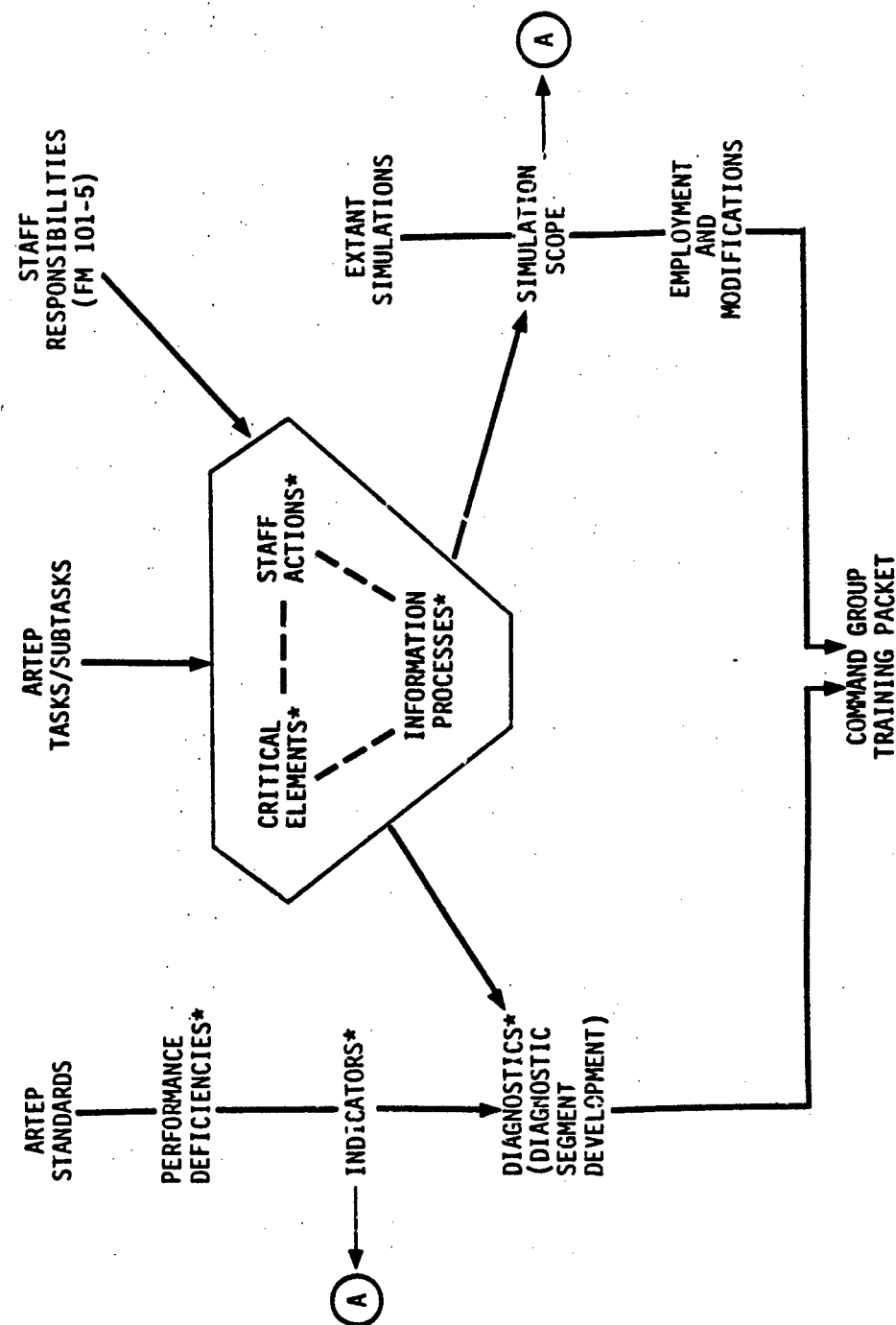
FIGURE 1-2. OBJECTIVE 2 INTERRELATIONSHIPS

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The Command Group Training Packet developed from Objective 2 can provide a vehicle whereby:

- Commanders and staffs can be introduced, and become accustomed to using ADP as an integral tool in the exercise of command/control.

- Various implementation strategies can be tested and refined.

- System requirements (ADP and total command/control) can be more adequately specified.

The current use and continuing development of computer-supported simulations, being examined under Objective 2, may thus provide an effective means of assisting the introduction of ADP as a useful command/control tool.

1.3   METHODOLOGY

1.3.1   A Systems View

The purpose of this objective is the development of a training, planning, and management system which addresses all significant aspects of conducting training with extant battle simulations. Since this objective concerns training command/staff groups which are the decision nodes of the tactical information system, it is useful to view such application of battle simulations in a systems context. Figure 1-3 portrays the information flow between the command/staff group and an appropriate combat simulation at division level. Although shown as a complete "G" staff, the same considerations apply to higher and lower echelons with varying degrees of complexity of the structure of the command/staff group. All of the extant simulations provide a human interface between the simulation and the command group. This is in the form of controllers (player/controllers) who represent higher, adjacent, and subordinate nodes in the information system. In the interest of realism, these interfaces usually occur over the organic communication means. The combat simulation, of course, substitutes information processes for physical processes in order to provide feedback to the command node in the form of information generated by the physical processes being simulated. Also indicated are the points in the information stream which can be tapped for ARTEP evaluation. One point represents direct evaluation (usually a matter of judgment on the part of the evaluator) of the command group outputs (e.g., the OPLAN). The second lies on the output side of the simulation and represents the simulated battle outcome of the command group input, e.g., was a force ratio of 5:1 actually achieved in the attack? The third taps the outputs of each of the individual staff elements.
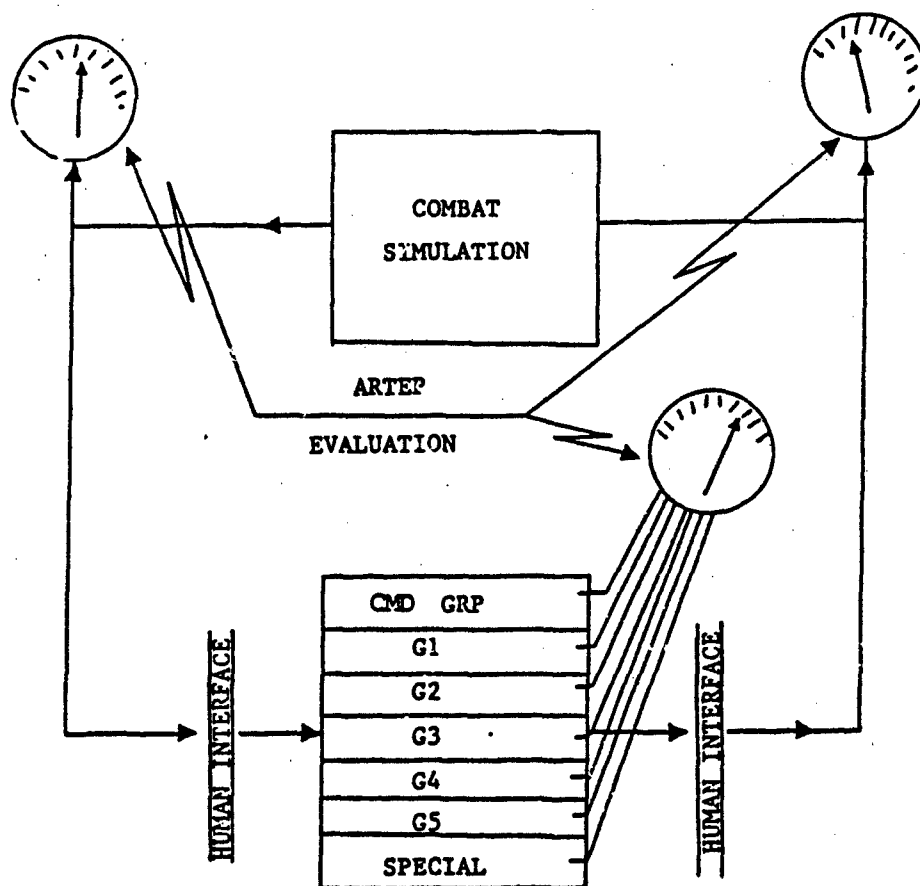
FIGURE 1-3. A TRAINING SYSTEM

To be credible the information flow emanating from such a simulation must have the properties of good drama, namely, unity of time, place, and action. Sackman,[1] from studies of the SAGE system, was the first to set forth some general principles concerning the dialogue between a human decision maker and a simulation. Although couched in the terms of the human/computer dialogue, his principles are equally applicable to the more general problem of man interfacing with any simulation:

- Real Time Parallelism: Real time digital events should operate in parallel with, and reflect the pacing of, the separate and distinct real time characteriestics of the men, equipment, and relevant situation events required to meet system goals. This parallelism should hold throughout the range of system capacity and associated computer operating time. Program design and control should accordingly have a structure that results in a close empirical fit between digital timing and environmental timing as determined by empirical performance effectiveness through system testing.

- Temporal Anthropomorphism: The computer system should optimize around the characteristic vari- abilities of real time human norms for effective system performance rather than try to fit the human into an alien pace that may ostensibly be more con- venient from program and equipment considerations.

- Conversational Principle: Human performance in man/computer dialog will vary with the similarity of the responding computer system, to the real time exchange characteristics of human conversation . . . As computer response time and message pattern deviate increasingly from real time parallelism . . . so will user performance deteriorate . . . (pp. 442-443).

Stated another way, the simulation must: provide the staff with information representing physical events at the pace those physical events would normally occur; allow the staff to operate at a normal human pace depending on workload; and provide information in a useful and easily recognized format. A major problem in the design and operation of combat simulations is that the information processes

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[1] Sackman, H., Computers, System Science Evolving Society. John Wiley, New York.

which substitute for the physical processes usually occur at many times the rate of the physical processes being simulated. This necessitates the insertion of delays approximating those of real world processes in order to maintain realistic time lines and system responses.

It can, of course, be argued that a closed loop representation of the tactical information system such as Figure 1-3 applies only to the control and coordination of combat operations and not to planning. Such a view ignores the twofold purpose of planning. A plan generated by any one node of the information system serves to generate additional, more detailed, planning by subordinates. This completion of the planning process is carried out (i.e., must be simulated) whether or not the original plan is ever implemented since the plan provides the sequence, frequently the schedule, of future events that must occur if the mission is to be accomplished. The completion of the planning process is, of course, included in the ARTEP criteria.

We come now to the crux of the problem; both the ARTEP and the simulation treat the command/staff group as an essentially unstructured "black box" and pay little or no attention to the information flow within that box. The ARTEP provides a series of training/ evaluation standards against which the command/staff group outputs are evaluated either directly (e.g., "traffic regulation and control plans are developed") or through the simulation (e.g., for the offense, "a friendly/enemy combat ratio of 5:1 or better at the point of decision"). The only diagnostic provision in the ARTEP is the recognition that the command/staff group has a series of major subdivisions consisting of the usual "G" or "S" and special staff elements. The ARTEP annex specifies the necessary contribution of each staff element to the specified standard and provides for sampling those outputs in order to evaluate staff section performance. The only diagnostic information that can potentially be provided by the simulation -- as long as all information continues to flow through a human interface -- is the command/staff group terminal from which each message emanated or to which it was delivered. These provisions are not, however, adequate to pinpoint training deficiencies. What the basic ARTEP and the Staff Supplement provide is a combination of combat outcomes and data package content descriptions which meet performance standards. But these are the result of a string of information processes. The training deficiency lies either in a faulty selection of the processes or sequence of processes -- or in faulty execution of the correct processes. What this implies is that diagnosis of the training deficiency(s) that led to an unsatisfactory outcome requires a diagnostic tool of some kind beyond the ARTEP and the simulation. Such a tool is required to identify the faulty process or string of processes that, in fact, led to the defective output. Because of the multiplicity of faulty processes and/or procedures that can lead to a defective output, such a tool would resemble a fault tree. The development of such a fault tree, in turn, requires that a logical structure of processes

and procedures internal to the command/staff group have been established so that the flow may be traced to the training deficiency that caused the impaired performance. Such a logical information flow structure should not be interpreted as a single set of SOPs which would be identical for all units and invariant over time, but rather a general set of principles for organizing the processing of information to include steps (individual and team behaviors) taken to adjust to varying degrees of stress -- particularly workload.

1.3.2   Methodology Overview

This effort consists of work under five major headings:

- Diagnostics. A major effort is required to develop the diagnostics needed to trace the very general deficiencies uncovered by ARTEPS into specific training deficiencies to be corrected through remedial training.

- Scope and Operation of Extant Simulations. A detailed review of both the ARTEPS and extant simulations is needed in order to determine the adequacy of the latter for the development of the outputs needed for comparison with the performance standards set tby the ARTEPS. The simulations must also be analyzed to determine their adequacy, as currently documented for collecting and reducing the needed data for rapid feed-back to players.

- Validation. The findings, conclusions, and recommenations developed during the course of the investigation will be validated by comparison with user experience at appropriate intervals.

- Incorporation of ADP (Maneuver Control System). During the later phases of the research the question of incorporating ADP into the training program will be addressed as will the question of its applicability in the training role to meeting the goals of Objective 3.

- Synthesis. The results of the foregoing facets of the effort will be synthesized into a "Command Group Training Packet" for use by comanders and senior staff officers in training their own command staff groups to meet training objectives and overcome training deficiencies using extant and/or modified battle simulations.

1.3.3   Study Execution

The actual execution of this study is being carried out according to the Procedural Chart of the Methodology shown in Figure 1-4. The chart shows that the study will traverse eight procedural steps to arrive at the final deliverables, the technical report and the training packet. The first three procedural steps (Steps 1 through 3) provide the necessary spade work before the program of study splits into two concurrent efforts, one related to the development of a diagnostic fault tree and the other focusing on the assessment of the scope and suitability of the extant simulations for various training objectives. The diagnostic development effort is shown on the lefthand branch of the chart. It must traverse Steps 4A through 7A, but must at one point be coordinated with intermediate results from the righthand branch. The scope assessment and suitability efforts are embodied in the righthand branch.

The work reported here covers Steps 1 through 3 and about half of Steps 4A and 4B.

1.4   ORGANIZATION OF THIS REPORT

Following this introductory section (Section 1) the remainder of this report consists of five sections, each of whose contents is briefly described below.

- Section 2. This section contains a summary of documentation and other source material reviewed during Year One, and a summary of findings and observations developed through field trips to Fort Leavenworth (two), Fort Riley and Fort Stewart during the course of the year. The latter directly and notably impacts development of the Command Group Training Packet by highlighting uses to which the various simulations are put in the field, and a sample (albeit small) of procedures employed.

- Section 3. This section sets forth the progress to date in developing the diagnostic structure to be completed in Years Two and Three. Central to the development of this structure are the interrelationships between ARTEPs, staff responsibilities and simulations shown previously at Figure 1-2, and the methodology set forth in Figure 1-4.

- Section 4. Presented in this section is an initial assessment of simulation suitability. The complete assessment of simulation suitability must await the full development of the diagnostics. The relationship between suitability assessment and the diagnostics is described.

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                    ┌─────────────────────────────┐
                    │ STEP 1.  Organize ARTEP tasks│
                    │ and subtasks for all echelons│
                    │ into a common framework.     │
                    └─────────────────────────────┘

        ┌────────────────────────────────────────────────────┐
        │ STEP 2.  Using FM guidance and the ARTEPs, develop   │
        │          separately the following:                  │
        │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  │
        │ Refinements of the ARTEP   │ The "critical elements" │
        │ standards for each subtask.│ associated with each subtask.│
        └────────────────────────────────────────────────────┘
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| DIAGNOSTIC DEVELOPMENT | STEP 3. Identify all staff actions associated with subtasks; identify the "procedural critical elements." | SCOPE AND SUITABILITY |
| EFFORT | | STUDY EFFORT |

←──── (concurrent) ────→

STEP 4A. Identify potential performance deficiencies associated with the subtask standards.

STEP 4B. For given echelon and extant simulation, determine whether scope covers the critical elements and staff actions.

COORDINATION: Determine the indicators to be used with respect to the critical elements.

YES ◇ ? NO

STEP 5A. Find all staff actions related to an indicated performance deficiency.

STEP 5B. Determine if training vehicle can be modified to make suitable for critical elements and staff actions.

NO ◇ ? YES

STEP 6A. Develop diagnostic "segments" which isolate the training requirement(s) indicated by the performance deficiency.

STEP 6B. Document requirements for new training vehicle accommodating the critical elements.

STEP 6B. Detail modifications (improvements) making training vehicle suitable for critical elements.

STEP 7A. Incorporate the individual segments into a general procedural fault tree.

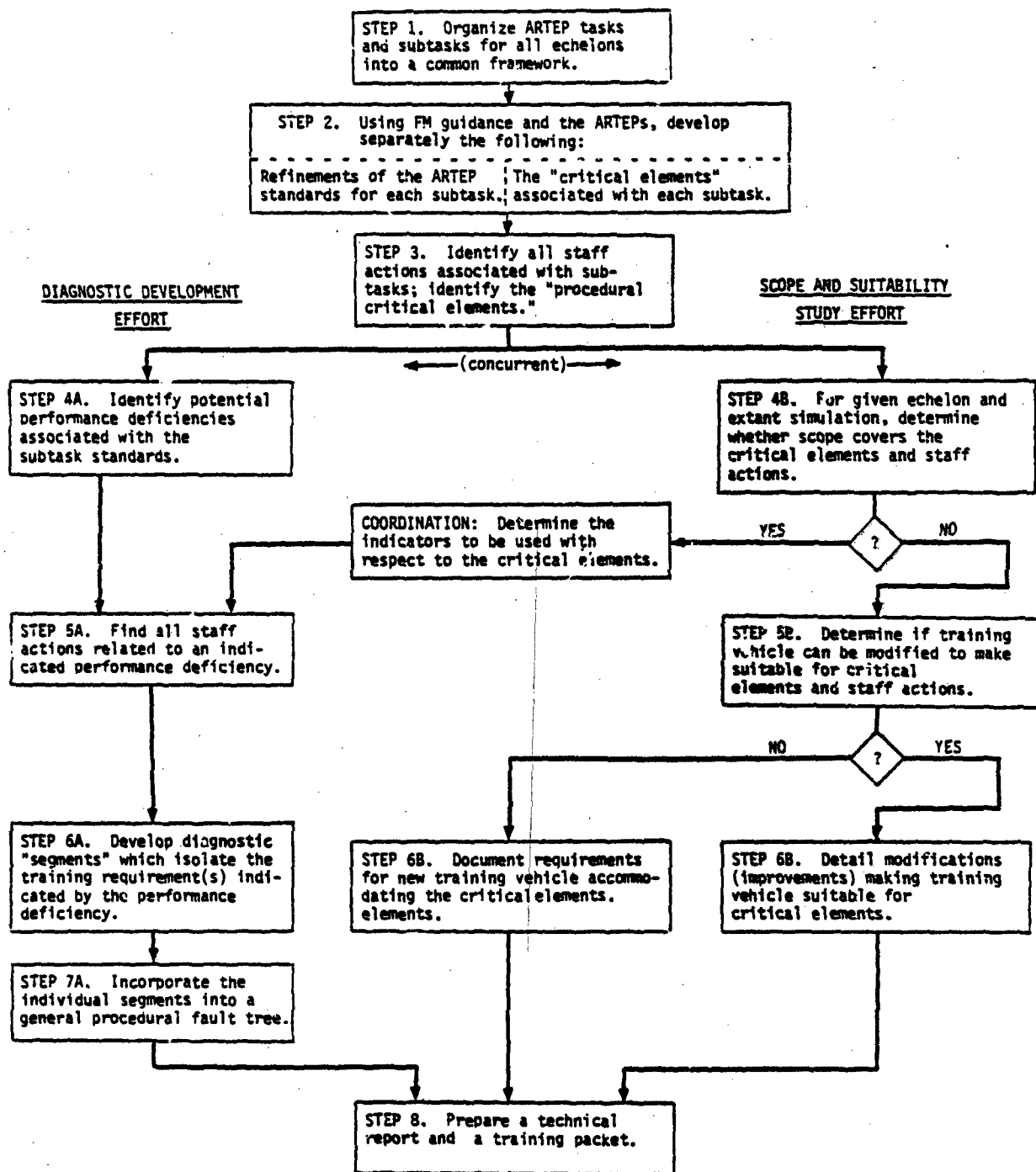**STEP 8.** Prepare a technical report and a training packet.

FIGURE 1-4. PROCEDURAL CHART OF THE METHODOLOGY

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- Section 5. This section briefly describes the potential for developing a command control research and training test bed, with the basis formed from the results of the Objective 2 study effort.

- Section 6. This section provides a summary of the findings and conclusions resulting from the first year study effort.

Appendix G, entitled "Training with Simulations," is the preliminary Command Group Training Packet (CGTP), presented in annotated outline form. While presented as a single outline format, it is envisioned that the CGTP will be a multi-volume product at the end of Year Three, with the various volumes focusing on one or more key aspects of training with simulations.

1.5 RELATED ACTIVITIES

As the research of Year One was being conducted, it became apparent that a number of on-going Army activities may impact the final product and therefore have been, and should continue to be, monitored by the study team with the assistance of the study sponsor. These include:

- Training activities at the Command and General Staff College (CGSC) (e.g., the Combined Arms and Services Staff School (CAS^3) program of instruction);

- The continuing Command and Control Special Program Review (C^{2}SPR);

- Activities of the offices charged with ARTEP development responsibilities;

- TRADOC training development activities (e.g., "Army Training 1990"); and

- Activities at the various Simulation Centers wherein innovative approaches are being developed and/or new requirements are being placed on simulations and support personnel due to actual or perceived mission and training objective changes (see also Section 2.2).

Significant for the first year's program was the lack of a final, approved version of ARTEP 71-2 (although extracts of the proposed final draft were provided by the study sponsor) and the projection of development by CATRADA of the "Single Methodology Manual Simulation - Battalion through Corps" (SMMC-BC), as well as CAMMS II. Progress in these simulation development programs should be monitored during Years Two and Three. Also deserving attention will be the status of Corps ARTEP activity and potential revisions of ARTEPs 100-1 and 100-2, and C^{2}SPR support of simulation usage.

SECTION II

DATA COLLECTION

2.1   REVIEW OF DOCUMENTATION

As part of the first year data collection efforts for Objective 2, SAI gathered and reviewed documentation pertinent to training command control groups. Table 2-1 lists the references reviewed and briefly describes the pertinent content of each. These references include ARTEPs, FMs, technical reports and training circulars, and the list will be expanded in the second year. The purpose of this literature review was threefold:

- To identify the general requirements of training as formulated in Army manuals such as ARTEPs, FMs, and TCs.

- To utilize pertinent information contained in previous studies of command group training in the development of the Command Group Training Packet.

- To determine the availability of documentation useful to commanders and senior staff officers for the training of their own staffs.

2.2   FIELD EXPERIENCE

2.2.1   Method

Four field trips were made by the Objective 2 study team: two to Army agencies at Fort Leavenworth to obtain background information relating to simulation activities and usage, ARTEPs, and other, but related, Army activities (e.g., C^2SPR and CATTS, with interaction with Objective 1 concerning the latter); and two to CONUS posts (hereinafter referred to as Post 1 and Post 2) to obtain information on field usage of simulations from both operators (i.e., Simulation Center personnel) and units/personnel using the simulations. Interview forms were employed, copies of which, with synthesized responses, are at Appendix F. A number of points discussed below were, however, developed in discussions with senior personnel, with whom forms were not used, and are therefore not enumerated in the appendix summaries.

TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS

ARTEP	PERTINENT CONTENT
ARTEP 71-2, Interim Draft Battalion Task Force (only Chapter 5, "Command Group/ Staff Module," reviewed)	- Critical tasks to be accomplished by command/staff in combat, expected combat conditions, and general standards associated with each task. - Brief descriptions of various battle and training battalion commanders and staffs. These simulations are listed in order of increasing complexity. Training objectives dictate the combinations of simulations used for a particular training exercise. - Uses of ARTEP 71-2 (e.g., as a means to train reserve component commanders and staffs; as a pre-ARTEP exercise for commanders and staffs; as a tactical laboratory, etc.).
ARTEP 71-2, Coordinating Draft (only Chapter 3, "Training and Evaluation Guideline," reviewed)	- Brief description of the threat expected to face friendly units. Included are summaries or basic threat doctrine and combat force structures. - Outlines of general missions applicable to most expected combat situations. - Outlines of missions specific to echelons (crew/team, squad/section, platoon, company, battalion task force). Also contained are C^3-specific missions and combat service support missions. - Listings of tasks to be accomplished, combat conditions expected to exist, and standards associated with each task.

TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS (Cont'd)

ARTEP	PERTINENT CONTENT
	- Outlines general responsibilities associated with S1, S2, S3 and S4. Provides general standards to be met by S1, S2, S3 and S4.
ARTEP 100-1, Brigade	- Critical tasks to be accomplished by commanders and staffs, expected combat conditions, and standards associated with each task.
	- Keys to successful training. Included are the three critical questions (Where should we be? Where are we now? How do we reach our goals?), development of the evaluation plan, selection and training of evaluators, and preparation of test documents.
	- Extremely brief descriptions of battle simulations available to brigade commanders.
	- Uses of the ARTEP in achieving training objectives (e.g., as a means to train reserve components commanders/staffs; as a pre-ARTEP exercise for commanders/staffs; as a tactical laboratory, etc.).
ARTEP 100-2, Division	- Same as ARTEP 100-1, Brigade.
	- Matrix of staff actions keyed to the critical tasks to be accomplished. Matrix arranged according to general and special staff sections. (Annex)
ARTEP ____, Corps	- (TO BE PUBLISHED)

TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS (Cont'd)

FM	PERTINENT CONTENT
FM 101-5 (July 1972) Staff Officers Field Manual	- Staff principles. Outlines authority and responsibilities of commanders. Discusses role of assistant commanders. Outlines staff functions (provide information, make estimates, make recommendations, prepare plans and orders). States general staff responsibilities and authority, to include relationship between staff, commanders of subordinate echelons and staffs of subordinate echelons.
	- Description of staff activities to include coordination, supervision, communication, analysis, estimates and preparation of plans and orders.
	- Principles and considerations of staff organization.
	- Responsibilities and duties of each staff officer. This corresponds roughly to the matrix of staff actions provided in ARTEP 100-2 (Brigade), but provides a different, more general perspective.
	- Problem solving techniques. Discusses in detail the estimate of the situation, and provides sample formats of written staff estimates. The content required of each staff section estimate is outlined. The staff study is discussed, with sample formats provided.
	- A detailed discussion of elements of and principles associated with planning. The required characteristics of a plan are given. General discussion of preparation of orders and annexes is also presented.

TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS (Cont'd)

<u>FM</u>		<u>PERTINENT CONTENT</u>
FM 101-5 (Coordinating Draft)	-	Same as FM 101-5 (1972).
Division	-	Primary differences are slight changes in format and modified figures.

<u>OTHER</u>		
TC 101-5, Coordination and Control of Division Operations	-	Outlines general functions of division commanders and staff. Addresses the need for staff coordination and supervision, and briefly describes staff estimates.
	-	Provides personnel and equipment summaries.
	-	Contains information given in FM 101-5. FM 101-5 provides greater detail.
TC 21-5-7, Training Management in Battalions	-	Discusses principles of and motivations behind training. No information regarding staff activities.
Miles Training and Evaluation Test, USAREUR	-	Describes results of a multi-phase training exercise for a battalion commander and staff. Phase one consisted of a sequence of two CAMMS CPXs. Phase two consisted of an integrated FTX using CAMMS and MILES.
	-	Provides some insights into diagnostics, feedback and indicators.
	-	Provides Training and Evaluation Outline.
FM 100-5	-	Sets forth the basic concepts of US Army doctrine.

TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS (Cont'd)

OTHER		PERTINENT CONTENT
	-	Discusses trends in weapon systems.
	-	Outlines "How to Fight" on the modern battlefield. In particular, the use of terrain, the importance of leadership, the roles of commanders at each echelon, the offense and defense, security, and C^3.
	-	General discussion of intelligence, to include sources (EM, Human, etc.), assets organic to various echelons, uses of intelligence in fighting the battle.
	-	General discussion of EW.
	-	Tactical nuclear operations.
	-	NBC operations.
	-	CSS.
Corps Information Flow (CACDA Report)	-	Outlines the following: Corps commander's information needs; flow (path) of information from source to Corps commander; and information processing by echelon.
ARI Technical Paper -- Training Battalion Command Groups in Simulated Combat	-	Reported findings from a study of 23 battalion command groups that participated in CATTS exercises. The performances of the groups were evaluated against 180 items derived from battalion ARTEP subtasks. The study identified the most critical subtasks for a given mission.
ARI Technical Report -- A Training Feedback System for Brigade Command Groups	-	Describes a system for analyzing the performance of a brigade command group during participation in CAMMS exercises. The purpose is to provide feedback to enable command groups to improve ARTEP performance.

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TABLE 2-1. PRINCIPAL SOURCE DOCUMENTS (Cont'd)

OTHER	PERTINENT CONTENT
ARTBASS/CATTS Training Development Study	- Package contains survey forms for collecting data on the command groups which have had, have not had or will have training on CATTS. The purpose of collecting such data is to facilitate the tracking of information through the CATTS exercises.
Review of SIMTOS (1967-1977)	- The review traced the origin and development of SIMTOS as a research vehicle.
	- Experiments utilizing SIMTOS were reviewed and critiqued.
	- Recommendations were given for future battle simulations, using SIMTOS and in other environments.

2.2.2   Observations Derived from Field Trips

The following paragraphs discuss observations derived from the field trips in terms of simulation uses, feedback methods, scenario/ exercise preparation and usage philosophy (i.e., centralization versus decentralization). The distinction between "Post 1" and "Post 2" is maintained in consideration of the fact that different posts have different views as to the role and employment of simulations, a not surprising but significant finding. Findings and data gaps are summarized in Section 2.2.3, to follow.

Simulation Uses

Post 1 objectives for simulation play, in addition to staff training, include tactical training and validation of plans, orders, and unit SOPs. This multiple usage reinforces the necessity for more closely refining the hierarchy of simulations, but complicates the original task which was focused on C^2 only. Nevertheless, this refinement must be accomplished to ensure acceptability. This usage was confirmed at Post 2. The term "rehearsal" should be added to the list for clarity (applicable to both posts). Examples are rehearsal of REFORGER operations at Post 1 and of a forthcoming FTX at Post 2. While ostensibly developed for staff training the other uses of simulations are noted by Army Training Support Center Bulletin No. 78-4, dated November 1978, entitled "Battle Simulations and the ARTEP." Specifically stated are:

- Portrayal of lethality of current weapon systems

- Capability to experiment with innovative tactics and techniques

- Rehearsals of contingency plans.

Further discussion relating to the validity of these goals is presented in the "philosophy" paragraph below. Two interesting -- and important -- benefits of simulation play were noted during the interview process (and are again in the tactical rather than staff training area):

- Deriving from the question relating to the importance of operations orders was a response noting the capability to observe how subordinates interpreted a given order. This is not ony a check on the quality of the order itself, but also a means by which leaders can ensure they are communicating with subordinates, that intent is in fact perceived, and finally where latitude is allowed, how subordinates will react.

- Second, simulations provide a mechanism by which leaders can "get to know one another "in a tactical context. This is complementary to the leader-subordinate notion above and is an important benefit

in that, for example, it is highly desirable that a battalion/company commander know how his counterpart on his flank will react to a given situation without lengthy explanations. A corollary to this benefit is that derived from observing "how the other fellow does it" with the objective of learning and adopting good techniques ar ' methods.

The tactical training emphasis has a number of aspects. First is the view that players and player-controllers should not have to learn "procedures" (e.g., methods for calculating outcomes), thereby allowing complete attention to tactical play. This approach clearly facilitates the introduction of computer assistance, which in fact has been done well at Post 1, to include gaining apparently complete acceptance by battalion level officers. This acceptance suggests a "generation gap" between younger and older officers -- the younger being more comfortable with the computer than the older. If true, this may point the way toward ways to structure the game hierarchy and in fact constitute an entry for ADP generally. Noteworthy is the fact that both simulations used at Post 1 (CAMMS and CBQ (computer-assisted DUNN KEMPF)) are computer assisted. PEGASUS is not used. The second aspect of the tactical training emphasis requiring attention is the use of an unclassified data base for weapon effects, together with local modifications to obtain what are termed "realistic" outcomes. The outcomes thus generated may lead to valid tactical conclusions; on the other hand, they may not -- a dangerous situation. Tactical "awareness," however, is certainly being taught well. Overall, there seems to be a nearly total acceptance of games and simulations at the battalion officer level as long as the focus is on tactical training. General acceptance for C^2 training, where these same officers act as "training aids," is not clear, but is apparently less. CAMMS, as an example, gets very poor marks at Post 2 at the junior officer level, being termed "too slow and confusing" and generating poor tactical results (BLUE can never win). Parenthetically, it appears that the younger officers may be "sharper" tactically than the older, more senior officers, due at least in part to the former feeling more comfortable in the gaming/simulation world. This deserves attention due to the potential impact on acceptability. Other benefits/uses cited were refresher training, training after periods of personnel turnover, and maintaining skills while other unit missions have priority.

Feedback

The feedback/critique process at Post 2 is excellent. A post-exercise critique is held immediately upon completion with both unit and Simulation Center personnel participating. Key to this critique are both unit notes and a log maintained by the Simulation Center which, while acting as the higher headquarters also monitors unit nets and is thus able to "observe" reporting timeliness and accuracy. The critique period is normally about two hours in length. A written report is then furnished to the commander of the unit participating. No copies are

furnished to the unit's parent headquarters -- more on this below. The process itself appears to be by agreement between the Center and individual units and is not formalized by division directive. Little light was shed on the use of ARTEPs and means for data collection and feedback at Post 1, except that the generation of "lessons learned" appears to be done on an informal and non-standard basis, depending largely upon the personality of the commander/exercise director. Much needs to be done here in providing guidance in the training packet. One possibility is more emphasis on maintaining unit/staff journals for all exercises and using these as a basis for critiques.

Scenario/Exercise Preparation

The Post 2 program is aggressive and essentially unit initiated. At least one battalion schedules a PEGASUS exercise monthly with supporting DUNN KEMPF exercises more or less regularly at company level (this is probably the extreme -- another battalion schedules PEGASUS once per quarter). Division FIRST BATTLE exercises are scheduled once per quarter.

At the unit level, the requesting battalion is contacted by the Simulation Center to flesh out the commander's stated objective. Scenario details and OPFOR are structured by the Simulation Center. Scenario inputs contained in the PEGASUS documentation are used as stimuli in the scenario construct. As at Post 1, Simulation Center personnel act as OPFOR. "Graduated" threats and ARTEP tasks are used to assist in meeting exercise objectives. The Simulation Center also conducts instruction for player/controllers. In summary, the Post 2 Simulation Center is a "full service" facility with excellent command support. The Chief, a captain, is an exceptionally well-qualified individual (with commercial wargaming experience, which he considers essential to the job (stated as "from zero to PEGASUS is a long way")). The assignment of a civilian to such facilities, as is reported to be the case at Fort Lewis, should be examined further as a means of providing continuity. As an aside, it appears that scenario libraries are being developed by the various Centers as supplements to the CATRADA published basic scenarios. An interchange of these scenarios between Centers should prove useful and save considerable time. The Post 2 Center itself is under the staff cognizance of the Director of Plans and Training (a post function) who in turn reports to the ADC-M. This is in contrast to Post 1, where the Center falls under the Division G3 (formerly G2).

Philosophy

A major point emerged from discussions at Post 2, namely centralization versus decentralization with respect to operation of simulations. The commander is apparently leaning toward decentralization, i.e., provision of simulation sets to brigades which would do (at unit level) what the Simulation Center now does. This results from a desire to see simulation work more aggressively pursued by integration into all

training programs as a matter of policy rather than the unit request-Simulation Center response which is currently the case. Alternatively, the quality operation of the Simulation Center, with resultant minimizing of preparation (and execution time) burdens for using units (and for the future, enhancement potential for the integration of ADP support) argues for the centralized approach. Decentralization will certainly result in difficulties in locating enough personnel qualified to organize simulation play effectively, although with strong command emphasis such could probably be found or trained. Such standardization as is desired will also require close command supervision (this comment applies similarly to variations between divisions). There are at least two interrelated corollaries to the above matter. The first is the degree to which tactical conclusions can be drawn when unclassified data bases are used, and/or local modifications are made using incomplete threat data. To the extent that the ATSC bulletin noted above recognizes experimentation with new doctrine and tactics, simulations are in the combat developments business in addition to training. The second is the degree to which the opposing force (OPFOR) is being properly played. It probably is, in that unclassified source documentation is generally good (FM 30-102 and "Soviet Army Operations,"IAG-13-U-78). Soviet defensive operations is cited as an area where this is not true. Nevertheless, "configuration control" over threat play should be an item of interest for senior commanders.

Also related to the centralization issue is that of evaluation versus training. An excellent discussion of this is found in the C^2SPR paper entitled "ARTEP Use in Command Control Training" (undated). As previously noted, results of battalion simulation exercises are not input to command channels at Post 2. The Center report goes directly to the commander scheduling the exercise and the verbal critique is clearly training oriented. One can make a case for evaluation or training on each side of the centralization-decentralization issue.

The concept of an "all echelon" simulation was also raised at Post 2. The commander is clearly interested in all personnel participating in a simulation exercise receiving training benefit. A FIRST BATTLE extended to PEGASUS detail was tried with mixed results. This concept bears directly on the "long term" simulation improvement portion of the ARI program and will be pursued later in conjunction with monitoring of CAMMS II and the CATRADA "Single Methodology" simulation developments.

2.2.3   Summary

The principal observation deriving from the field trip experience is that simulations are being put to many uses beyond that originally envisaged, i.e., staff "drivers" for command/control training. These include:

●   Tactical training (and resultant "lessons learned with respect to OPFOR tactics")

- Weapon capabilities and employment techniques

- Validation of SOPs and operations plans

- Tactical/doctrinal experimentation.

These uses put special stresses on the extant simulations in that, for instance, OPFOR play must be sound in terms of interpretation of OPFOR doctrine and tactics, and care must be taken not to draw erroneous conclusions given that combat results tables do not reflect current weapon capabilities, and are, in fact, based on unclassified effects data.

In a broad sense, it was also apparent that the younger generation of officer personnel (i.e., major and below) are generally comfortable with simulations, albeit while still criticizing certain aspects of one or the other. This derives in some sense from the proliferation of commercial war games, both manual and automated, in the past ten years, and the concomitant explosion of mass market computer products. In combination, these factors may well result in a demand for ADP support for simulations which may in turn translate into a similar demand for ADP support for command/control as these same officers rise in rank and responsibility.

As noted in paragraph 2.2.2, both posts were actively using simulations although in different ways. An attempt was made in the interview process to determine why simulations would not be used. The only significant reasons uncovered to date were a general reluctance to change, particularly in units where Master Incident Lists (MIL) and scenarios are on file and readily available, and a reluctance to devote the time required in highly competitive environments where no immediate benefit is perceived. "Negatives" with regard to simulation usage need to be addressed more completely in Year 2, together with the issue of centralization versus decentralization.

The wide variance in feedback methods noted suggests this area as a principal task for Year 2, in that feedback is essential to the training process, both in establishing objectives and prescribing remedial training. A related subject is the issue of evaluation versus training. Training appeared to dominate at the posts visited, but the sample size should be increased and the subject addressed in considerably more depth as it applies to continuing simulation usage.

The need for updated materials noted in the examination of the simulations by the study team was validated by the field trips. The desire of CATRADA not to furnish "bandaid" fixes to the field pending development of the single-methodology simulation represents an opposite view (some material is furnished to TRADOC for inclusion in its "Battle Report" to the field, with copies directly to USAREUR and CONUS commanders). This dichotomy deserves further attention.

The necessity for careful "front end" determination of objectives, planning, and training of player-controllers where needed, noted by the study team was also validated by the field interviews. These needs also bear on the centralization versus decentralization issue.

In summary, it was found that the simulations are dramatically filling a set of needs in the field, and it is believed that improvements and assistance will be welcomed.

SECTION III

DIAGNOSTICS DEVELOPMENT

3.1   PROCEDURAL FAULT TREE FOR IDENTIFYING TRAINING REQUIREMENTS

        The cornerstone of the research effort is the development of a
diagnostics package. As will be shown in subsequent paragraphs, the
assessment of simulation suitability will be based upon the formulation
of the components of the diagnostics; therefore, simulation suitability
assessment cannot be completed until the diagnostics have been fully
developed. The relationship between diagnostics and simulation suita-
bility will become clearer as the diagnostics concepts are developed in
this section.

        It is currently envisioned that the diagnostics will assume the
structure of a fault tree, initiated by the occurrence and observation of
a staff performance deficiency. This section reports on the methodology
and findings to date in the development of that general procedural fault
tree intended to translate performance deficiencies by a command group/
staff in a training exercise into specific remedial training requirements
for that staff. This diagnostic tool, when fully developed, will provide
an objective, trouble-shooting procedure for identifying the staff
element (and the members thereof) that needs corrective training and for
isolating the nature of the training required.

        The development of the diagnostic fault tree is proceeding ac-
cording to the Procedural Chart of the Methodology, Figure 1-4. It
should be noted in the chart that the development involves Steps 1
through 3 and Steps 4A through 7A, but must be coordinated with the
findings regarding appropriate indicators to be used in a given training
vehicle. Diagnostic development goes down the lefthand branch of the
chart, but requires incorporation of some of the results found in the
righthand branch.

        This section contains the findings stemming from Steps 1 through
3 as they apply to a division-level command group/staff. It also shows
sample findings in the same methodological framework applicable to
brigade-level, battalion/task force, and corps-level command groups, re-
spectively. The section begins by specifying the common reference number
system adopted here for the command group/staff tasks and subtasks con-
tained in the available ARTEP documents.[1,2,3] In this framework, the

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[1] US Department of Army Training and Evaluation Program, Division
     Command Group and Staff, ARTEP 100-2, June 1978.

[2] US Department of Army Training and Evaluation Program, Maneuver
     Brigade Command Group and Staff, ARTEP 100-1, May 1978.

[3] US Department of Army Training and Evaluation Program, Battalion/Task
     Force Command Group and Staff, ARTEP 71-2, (DRAFT).

section develops the <u>critical elements</u> associated with each CG/staff sub-task. The section then continues by developing the second key element, <u>staff actions</u>, the entities whose processing characterize the real activity of an individual staff section or element in a combat situation. This material stems from earlier work[4],[5] generated by ARI, but here is extended to include planning staff actions and to cover brigade-level and task force battalion staffs. The section then returns to the common reference subtasks and presents a proposed restatement of the ARTEP standards and the corresponding <u>potential performance deficiencies</u> associated with each subtask. The subject matter presented up to this point in the section covers in considerable detail Steps 1 through 3 of the methodology (Figure 1-4), but it does not demonstrate how the remaining steps will ultimately generate the <u>diagnostic segments</u> associated with an actual performance deficiency. The section is concluded by presenting such a demonstration. The concluding subsection provides two tentative "walk-throughs" of the diagnostic development methodology.

With the exception of the concluding "walk-through" material, the contents of this section are the point of departure for the simulation suitability discussion in Section 4.

3.2   COMMON REFERENCE FRAMEWORK

The first procedural step in pursuit of the Objective 2 study was to create a common reference numbering system for the command staff tasks and subtasks given in the available ARTEP documents.[1],[2],[3] The three documents* each contain a training and evaluation outline for the command group/staff at its echelon. The training and evaluation outlines specify a set of numbered tasks and subtasks to be carried out by the command staff. With certain exceptions that are noted in the following paragraphs, the stated tasks and subtasks are identical across the three documents but the numbering systems are not. For the purpose of providing an orderly framework for this study a new reference numbering convention has been adopted.

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[4]   Tiede, R. V., et al., <u>Design of an Integrated Division-Level Battle Simulation</u>, US Army Research Institute for the Behavioral Sciences, Technical Report 420, August 1979.

[5]   Tiede, R. V., et al., <u>Some Guidelines for Effective Task Design in Command Control Simulations</u>, US Army Research Institute for the Behavioral Sciences, Research Note 80-40, November 1980.

[1]   Op. cit.

[2]   Op. cit.

[3]   Op. cit.

*   No ARTEP document is available at this time for corps-level command groups.

The ARTEP Task and Subtask Descriptions under this common reference are shown in Table 3-1. It can be seen from this table that some subtasks are not applicable to higher echelons and others not applicable to lower echelons. These differences reflect in part the variations in the scope and emphasis of command and control functions at the different echelons.

There are, moreover, two areas in which the task or subtask descriptions from the documents have been omitted entirely from the table. These are as follows:

● Subtasks related to the training of subordinate units.

● Tasks and Subtasks related to troop leading during battle.

The above entries were omitted because it appears doubtful that they can be accommodated in the training vehicles under study, and, more importantly, they are not applicable to the command and control functions of a staff.

3.3 CRITICAL ELEMENTS

3.3.1 General

During the course of the first-year research it became apparent that command and control activities can be classified in at least two different ways: object system-oriented and procedural-oriented. The distinction arises from the inherent composition of the tactical force which includes a command and control system and an object system. The C^2 system consists of the commanders at all echelons, their staffs, and all communications, sensors, personnel, equipment, facilities and procedures used in planning, directing, coordinating, and controlling. The object system consists of the forces being commanded and controlled, i.e., the effectors that convert C^2 decisions (information) into real world events and also provide feedback in the form of information about real world events. The C^2 system can thus be viewed as an information-processing/decision-making system whose output provides the means by which the object system is controlled. A dual orientation of the tactical C^2 system thus obtains: the procedural orientation is derived from the information processing nature of C^2 activities, while the object system orientation results from the nature of the object system activities being controlled and the environment in which the object system operates.

Figure 3-1 attempts to portray this concept by displaying the basic elements in a simulation training system. Shown at the center in the dotted box are the principle elements of both Red and Blue object systems and their environment. Shown outside the simulation are both a Blue and a Red C^2 group. Flowing from the simulation to the C^2 groups is both initial information which sets up the problem to be solved and feedback which is information about the environment and combat outcomes. Flowing from the C^2 groups into the simulation are decisions in the form

Table 3-1

ARTEP TASK AND SUBTASK DESCRIPTIONS
COMMON TO ALL ECHELONS

Containing Cross-References for All Command Group ARTEPs

Common Reference for This Study	Task or Subtask Description	Corps-Level ARTEP ?	Division-Level ARTEP 100-2	Brigade-Level ARTEP 100-1	TF-Level ARTEP 71-2*
I	Develop Plan Based on Mission		1	1,2	1,1e,1f,2f, 2g,2h,2i, 2q
Ia	Prepare plan and communicate orders.		1A	3G	1,2r,3c
Ib	Organize for combat		1B	3	2p
Ic	Plan for fire support		1D	1I,1J,1L, 1E	2j,3b
Id	Plan for employment of nuclear & chemical Wpns.		1E	(none)	(none)
Ie	Integrate CSS into Scheme of Maneuver.		1F	3J,3K	2o,3d,3e
If	Plan for employment of EW.		1G	3I	21
Ig	Develop commo plan.		1H	3F	2k
In	Plan for employment of obstacles.		1I	3H	1h,1i,2m
Ii	Plan for river crossing		1J	(none)	(none)
Ij	Establish priorities for Air Defense.		1K	(none)	(none)
Ik	Integrate available air assets.		1L,1M	1K	2n

* Entries from Command Group Module (ch 5) of ARTEP 71-2 (draft). Later draft being coordinated as of July 1981.

Table 3-1 (Continued)

ARTEP TASK AND SUBTASK DESCRIPTIONS
COMMON TO ALL ECHELONS

Containing Cross-References for All Command Group ARTEPs

Common Reference for This Study	Task or Subtask Description	Corps-Level ARTEP ?	Division-Level ARTEP 100-2	Brigade-Level ARTEP 100-1	TF-Level ARTEP 71-2
II	Initiate Intelligence Preparation of Battle-field		2	1B,2,2A	1c,2a
IIa	Prepare analysis of area of operations.		2A	2B,2C,2D	2b,2c,2d
IIb	Prepare intelligence collection plan.		2B	(none)	(none)
IIc	Prepare reconn, survivability, and target acquisition plan.		2C	(none)	(none)
III	Control and Coordinate Combat Operations		3	6	4
IIIa	Implement, update plans and orders.		3A	6A,6B	4c
IIIb	Direct combat operations and coordinate CP functions.		3B,3C	6C	4a,4d
IIIc	Maintain current situation and status of own forces.		3D	6D	(none)
IIId	Concentrate/shift combat power.		3E	8,8A,8B, 8C,8D	(none)
IIIe	Conduct Psych/CM operations		3F	(none)	(none)
IIIf	Coordinate air space utilization.		3G	(none)	(none)
IIIg	Direct/coordinate EW		3H	7C,10A,12A	5a,5g

Table 3-1 (Continued)

ARTEP TASK AND SUBTASK DESCRIPTIONS
COMMON TO ALL ECHELONS

Containing Cross-References for All Command Group ARTEPs

Common Reference for This Study	Task or Subtask Description	Corps-Level ARTEP ?	Division-Level ARTEP 100-2	Brigade-Level ARTEP 100-1	iF-Level ARTEP 71-2
IV	See the Battlefield and the Enemy		4	5	4b
IVa	Collect intelligence.		4A	5A,5B	(none)
IVb	Analyze enemy capabilities and probable C/As.		4B,4C	5C	(none)
IVc	Disseminate critical intelligence.		4D	5D	(none)
V	React to Enemy NBC Operations		5	12	(53,5f)
Va	React to nuclear attack.		5A	23C	5f
Vb	React to chemical and bio attack.		5B	12B	5e
VI	Secure and Protect the Unit		6	10	5
VIa	Implement OPSEC.		6A	10A	5
VIb	Conduct counter-intelligence ops.		6B	10B,10C	5a
VIc	React to enemy radio jamming, deception.			6C	10D 5i
VId	Conduct RAP operations.		6D	10F	5h
VIe	React to enemy air attack.		6E	10G	5c,5d
VIf	React to loss of key CG members.		(none)	12D	4e

Table 3-1 (Continued)

ARTEP TASK AND SUBTASK DESCRIPTIONS
COMMON TO ALL ECHELONS

Containing Cross-References for All Command Group ARTEPs

Common Reference for This Study	Task or Subtask Description	Corps-Level ARTEP ?	Division-Level ARTEP 100-2	Brigade-Level ARTEP 100-1	TF-Level ARTEP 71-2
VII	Provide CSS for the Units		7	9	6
VIIa	Arm the system.		7A	9A,9D	6a
VIIb	Fuel the system.		7B	9A,9D	6b
VIIc	Fix the system.		7C	9B	6c
VIId	Support the troops		7D	9C	6d

SIMULATION OF THE OBJECT
SYSTEMS AND THEIR ENVIRONMENT

RED
C² GROUP
(INFORMATION PROCESSED)

(INFORMATION)

DECISION
(INFORMATION)
FEEDBACK

SCENARIO:
FORCES
SITUATION
MISSION(S)

PROVIDES:
INITIAL CON-
DITIONS AND
CONSTRAINS

DECISION
OUTCOME
GENERATOR
(OBJECT SYSTEMS)

COMBAT
OUTCOMES

(INFORMATION)

DECISIONS
(INFORMATION)
FEEDBACK

OBJECT SYSTEM
CRITICAL ELEMENTS

BLUE
C² GROUP
(INFORMATION PROCESSED)

PROCEDURE
CRITICAL
ELEMENTS

FIGURE 3-1. BASIC ELEMENTS IN A SIMULATION TRAINING SYSTEM

of information. The simulation is simulating the real world events resulting from decision information and the production of feedback information about combat and environmental events. Clearly, the information flowing in and out of the C^2 group is classified into data headings that apply to the object system and its environment. On the other hand, what is being done to the information input into the C^2 group is some kind of information processing the combination of which can be termed procedures. A convenient analogy is almost any kind of production plant which operates on raw materials (inputs) to produce finished products (outputs) and whose activities are described in terms of what is being processed, the nature of the process, and who is responsible for that processing. Similarly, the activities occurring within the C^2 group can be described in terms of who is responsible for which processing of what kind of information.

A glance at any one of the ARTEPs confirms that these consist of a set of directives that describe various activities or tasks to be performed by the commander and principal members of the staff. As such, they consist of sentences which contain:

● A subject -- tells who is responsible for the specified task or subtask.

● An action verb -- describes or alludes to the set of information processes to be performed; this provides the basis for the procedural orientation.

● An object -- describes the kind or class of information to be processed; it can be thought of as a series of file headings associated with the object system.

Table 3-1 omits the "who" but clearly lists the action verbs (plan, analyze, compile, integrate, disseminate, monitor, etc.) and the classes of object system information.

The subtasks prescribed by the ARTEPs and compiled in Table 3-1 were further dissected into sub-sub-tasks to determine more precisely the individual activities comprising a given subtask. The issue of resolution (i.e., how far is the process of subtask decomposition to be carried) was not a trivial matter, since the validity and applicability of the final Command Group Training Packet and Diagnostic Tree depend to a large extent on that selection. If the resolution of the constitutent activities associated with ARTEP subtasks is not carried far enough, the resulting training guidance will be little better than that provided by existing ARTEPs. On the other hand, if the analysis of subtasks is taken to too fine a "grain size," the sheer number and minuteness of the derived activities will render the practical application of the guidance useless. Thus, the question of the resolution of subtask decomposition was carefully considered vis-a-vis the goals associated with development of the Training Packet and Diagnostic Tree. The grain size selected, i.e., the level at which the breakdown of subtasks ceased, is designated

as a list of <u>critical elements</u>. A critical element is defined as an important activity specified by or derived through analysis of an ARTEP task or subtask and which is necessary for the performance of that task or subtask.

A list of critical elements at division level was prepared, and is shown in Appendix C. This was based on the division level ARTEP[1] and the subtasks specified therein were further broken down into important activities with the aid of other Army doctrinal manuals.[6,7,8,9,10]

The selected grain size satisfies the two requirements noted above: each critical element is an important piece or "packet" of activity (oriented to either information processing or the object system or both) which is a much more specific and detailed formulation than that provided by ARTEP tasks and subtasks, yet the number of critical elements derived for division is not too large to manage. It is noted that the formulations of the set of division critical elements were derived primarily from existing ARTEPs and FMs while the grain size chosen to be designated critical elements was a subjective choice. The factors used in the selection were the utility of the critical elements within the diagnostic structure currently envisioned (i.e., how useful are the critical elements in pinpoir+ `ng the nature and causes of an oberved performance deficiency, to include the responsible individual(s)), and the applicability of the set of critical elements within the Command Group Training Packet.

3.3.2   Application of Critical Elements

The derived list of critical elements provides one pillar upon which the foundation will be built for diagnostics development as well as simulation suitability. (The other pillars are a model of C^2 group information processing and standards of staff performance; these will be

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[1] Op. cit.

[6] US Department of the Army, <u>Staff Organization and Procedure</u>, FM 101-5, Washington, July 1972.

[7] US Department of the Army, <u>Combat Intelligence</u>, FM 30-5, Washington, October 1973.

[8] ----------, <u>Staff Organization and Procedure</u>, FM 101-5, Coordinating Draft.

[9] USA Command and General Staff College, <u>Commander and Staff</u>, RB 101-5, Fort Leavenworth, July 1968.

[10] USA Command and General Staff College, <u>Electronic Warfare</u>, RB 32-20, Fort Leavenworth, July.

discussed in succeeding subsections.) As defined above, critical elements are the building blocks for ARTEP tasks and subtasks. By their nature, they specify both the subject matter of the information about the object system and environment which must be processed by the C^2 group and also the nature of the information processing. Therefore, critical elements specify the "nuts and bolts" of the activities to be performed by the command and control group in carrying out its assigned mission. Since the final Command Group Packet will consist of "mixes" of simulations for each prescribed set of training objectives, and a diagnostics tree for identification of training deficiencies and specification of corrective action, the role of critical elements will be examined relative to each of these considerations.

3.3.2.1 Role of Critical Elements vis-a-vis Simulation Suitability

The notion of critical elements provides a standard, systematic and comprehensive approach to determining the suitability of each simulation employed with various scenarios and training objectives. In evaluating the suitability of a particular simulation, it is useful to divide the evaluation into first order, second order and third order analyses. First order analysis is an evaluation of the scope of a simulation, and determines if a given simulation "plays" ARTEP tasks and subtasks, without regard to the manner in which the tasks and subtasks are played. Basically, first order analysis simply answers yes or no to the question: Does simulation x play ARTEP task N?

Second order analysis entails a detailed examination of the mechanism by which a simulation allows a particular task to be handled by the players (if the answer to the question above is yes), or the specification of viable modifications to incorporate unplayed tasks within the simulation scope (if the answer is no).

Third order analysis provides a complete picture of the scope and suitability of a given simulation for alternative scenarios, set of training objectives and type of exercise. This is done by integrating the individual results obtained through the first and second order analyses, determining simulation shortfalls, and drawing up a list of possible modifications to be further researched in Year Two.

The derived list of critical elements greatly simplifies the first order analysis. Each simulation can be examined vis-a-vis each of the critical element object system data categories and those which the simulation does and does not play can be noted. Because of the precision and magnitude of the critical elements, the first order analysis provides a good indication of the scope of each simulation.

In a similar manner, object critical elements facilitate second and third order analyses, and allow for determination of simulation suitability to a much finer degree than is possible using the current ARTEPs. The detailed discussion of first, second and third order analyses of simulation suitability will be reserved for Section 4.

3.3.2.2 Role of Critical Elements in Diagnostic Developments

The detailed examination of the role of critical elements vis-a-vis diagnostics development will be presented in Section 3.6, but a cursory discussion is appropriate here. The application of the diagnostics tools following a training exercise is triggered by the occurrence of one or more performance deficiencies during the course of the exercise. Although not yet formally structured, it is expected that the diagnostics will consist of separate diagnostic segments, each initiated by a different class of performance deficiencies (to be defined in Section 3.5). Once triggered, a particular diagnostic segment will be applied as a training feedback mechanism, such that the segment will be traversed downward along its various nodes and "leaves." Some of the nodes will address procedural issues; others will address the object system activities of the Command Group and staff. In particular, these object system activities will be evaluated vis-a-vis ARTEP and FM standards, and will be tested for completeness, accuracy, timeliness and validity (these terms to be precisely defined later). The evaluation of these object system staff activities is expedited, and carried to a much deeper and more useful level, through the use of critical elements. In addition, as will be discussed later in this report, the possibility of installing the diagnostics on computers is enhanced by the concept of critical elements.

3.4   STAFF ACTIONS

The next key element in this study is that of the staff actions carried out by various sections or elements of a command control group. As defined in Appendix A, a staff action is a piece of organized activity by an individual staff section directed at, or contributing to, the fulfillment of one or more staff tasks or subtasks. All staff actions begin with some kind of triggering event; all actions end with one or more concluding events. Staff actions are a key part of the study because they make clear the fact that command groups always discharge their responsibilities vis-a-vis the staff tasks and subtasks and the critical elements in discrete time interval "packets." Whereas the stated tasks and subtasks and the critical elements often imply some kind of mechanism continuous in time, staff actions demonstrate that in reality a staff section or element engages in activity satisfying a particular responsibility only during the time interval between the triggering event and the last of the concluding events. A staff section at any point in time may have a large number of different staff actions in process simultaneously and the separate actions could pertain to many different tasks or subtasks. But if none of the actions in process is related to a particular staff subtask, then the section will have discharged for the moment its responsibility with respect to that subtask.

3.4.1   A Preliminary Model of C^2 Group Behavior

It was orginally proposed and our research plans indicated that we would use the model developed in the earlier SAI study "Division Level

Battle Simulation"[4,5] as the starting point for the current study. As the work progressed it became increasingly clear that the earlier model of staff information flow and processing, which had been developed for the purpose of simulating staff actions, was much too rigid to reflect the behavioral nuances of live staffs. It was clearly impossible to trace information flow in the CATTS data to that level of detail in the Objective 1 effort; it did not provide an adequate framework for developing the diagnostics needed in Objective 2; nor did it provide a useful framework for studying the difficulties of supporting Army tactical C^2 with automation in Objective 3. On the other hand, the earlier model did provide some useful insights and some usefully defined components such as staff actions, triggers, and elementary operations. Among the insights developed were the following:

- Although the actual sequence of elementary operations performed by live staffs is highly variable both by type of staff action and as a function of time (load, mood, etc.), staff behavior in processing staff actions does seem to cluster into at least three phases: input processing, decision making, and output processing. The first and last of these phases are primarily administrative and affect the routing rather than the content of the data stream.

- The notion of elementary operations began by noting observable changes in procedural behavior by members of staff groups and, thus, were clearly tied to actions by a single individual. This notion was extended in the ARI simulation study to break down the cognitive operations into logically distinct components whether or not these distinctions were observable by an outside observer. They were, however, still thought of as individual behaviors with one or two exceptions. It has become increasingly clear that several of the higher level cognitive operations are frequently performed by small informal groups rather than by a single individual.

These insights led to consideration of the Hierarchical/Input/ Process/Output model, frequently referred to as the HIPO method for program design. This model was formulated to represent the requirements and functions of components of decision nodes in an information system.

Groups of individuals engaged in information processing, just like groups engaged in any other joint activity, tend to organize themselves into specialties. A division of labor follows which takes advantage of the special skills and experience -- and place in the pecking

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4 Op. cit.

5 Op. cit.

order -- of each individual. This has the significant advantage, from the viewpoint of observing command control functions and processes, that multiple new interfaces now exist. Information must now be transferred, not only at the decision node boundaries, but also between individuals and between individuals and data storage devices (files, maps, displays, and terminals). Additional functions and individual processes can now be discerned as the products flowing between them become observable.

The first major new function that emerges is that of a buffer between the input and output processes and the higher level decision processes. This is illustrated in Figure 3-2. The raw data extracted from the information stream by the input function is prepared for the decision makers by sorting it, associating it (placing it in context), aggregating and organizing it into a form most easily assimilated for decision making. Similarly, the decision must be prepared for output processing to transform it into information that will be useful to the agency(s) that will implement it.

The arrows shown in Figure 3-2 do not imply that this is a continuous process, nor that every input produces an output, nor, even, that all outputs can be traced to specific inputs. Just as individual human responses are not necessarily triggered by external stimuli, group responses can be triggered by internal stimuli which can vary in complexity from periodic reports triggered by an internal clock to actions taken as a result of profound insight or hypotheses generated long after the arrival of the latest segment of raw data that has been considered.

The division of labor does not, however, stop with the functions identified in Figure 3-2. The functions identified there are not always performed by a single individual so that processes comprising each of these functions can also be identified. Figure 3-3 expands the model to show identifiable processes and their interrelationship to a data base. The model is probably best described by defining its components, its attributes, and the product on which it operates. This will be done in the sequence indicated in the figure rather than alphabetically. Although an effort will be made to keep the discussion general, i.e., so that it applies both to manual and ADP-assisted groups, the initial discussion will concentrate on the manual mode. The definitions of the model components follow:

> COMMAND CONTROL GROUP -- An assemblage of two or more individuals and the equipment (communication terminals, files, displays, data processing equipment, etc.) needed to function as a decision node in a tactical command control system. Members of the group are collocated so that nonverbal communications are facilitated; conversely, they are in some degree shielded from nonverbal communication with non-members of the group. Military staffs of larger units usually function as a number of separate and distinct command control groups (staff sections).

DECISION PROCESSES

PRE-DECISION
PROCESSING

POST-DECISION
PROCESSING

INPUT
PROCESSING

OUTPUT
PROCESSING

EXTERNAL INFORMATION STREAM
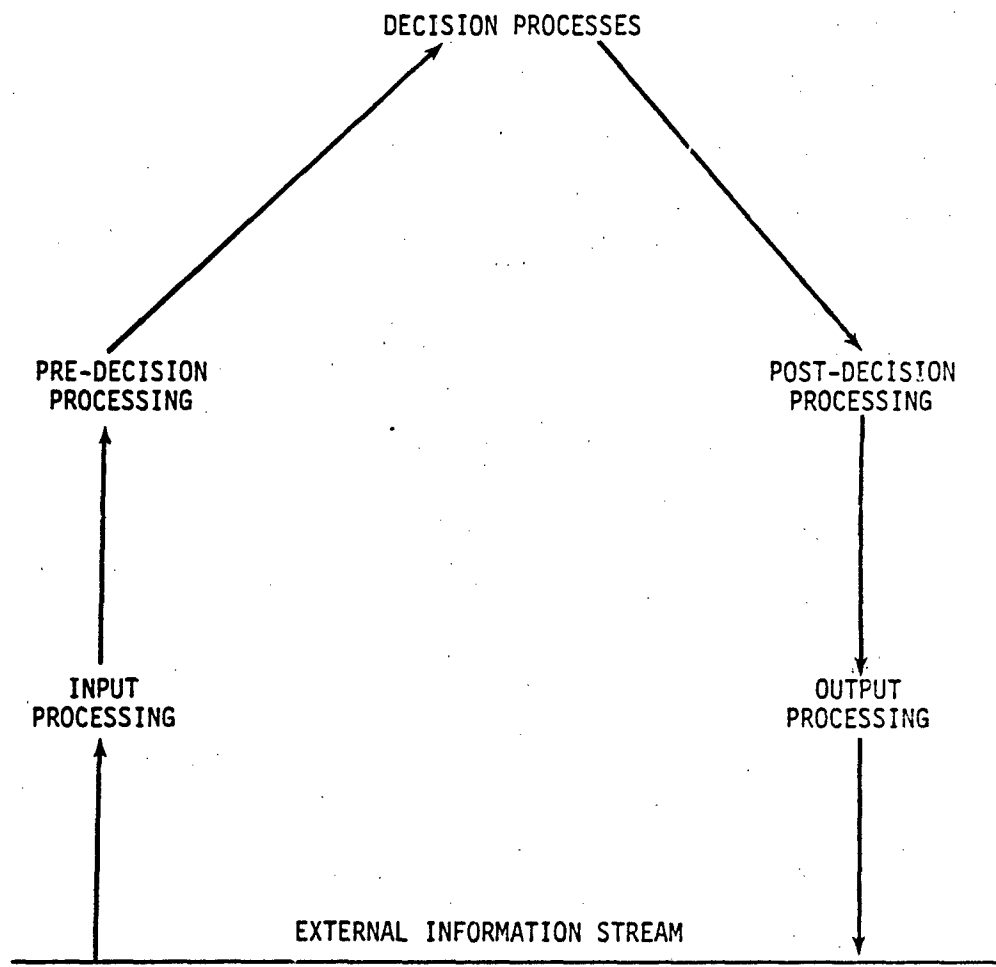
FIGURE 3-2.   COMMAND AND CONTROL GROUP INFORMATION PROCESSING
             FUNCTIONS

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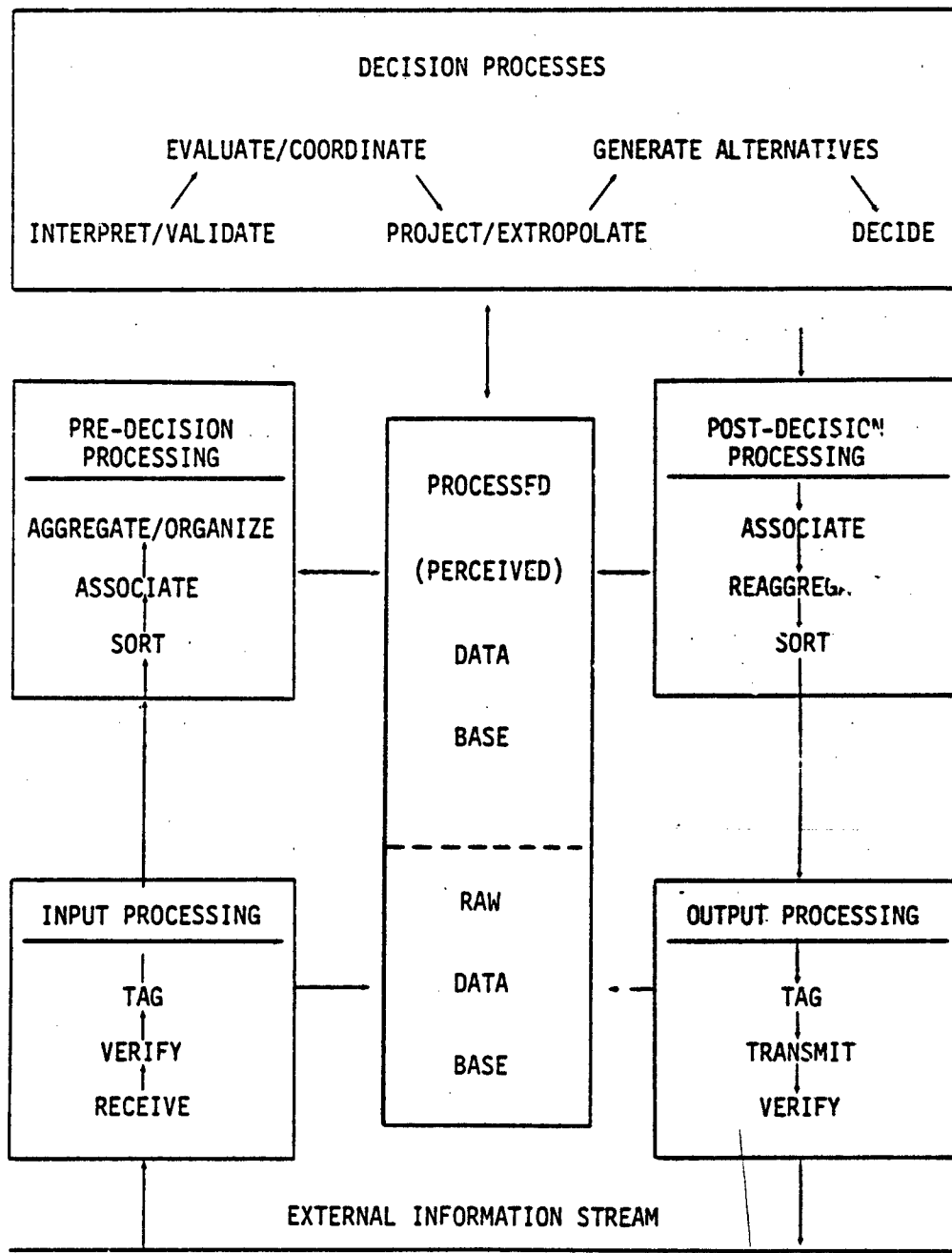
FIGURE 3-3. COMMAND AND CONTROL GROUP INFORMATION PROCESSING BEHAVIOR MODEL

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EXTERNAL INFORMATION STREAM -- This includes all information received by the command control group from sources outside itself and all transmitted by the group to recipients outside itself. It includes all means of communication (oral, written, electrical, gestures) and includes information to and from other command control groups (staff sections).

MESSAGE -- An ordered selection from an agreed set of signs (alphabet) intended to communicate information.[11]

RECEIVE -- The process of accepting the string of signs or symbols that constitute a message -- or the process of making a one-for-one transformation of the incoming string, e.g., copying an incoming voice message or repeating aloud an incoming message. This process does not include transforming the string of symbols into information.

VERIFY -- The process of ensuring that the accepted string of signs or symbols agrees precisely with the string transmitted by the sender. This process may require transmission of procedural signs or even retransmission of the message string by the receiver.

TAG -- To affix an identifier (frequently a sequence number) to a message to facilitate retrieval from the raw data base.

RAW DATA BASE -- A file containing incoming and outgoing messages processed only through the verification and tagging stages. Example: Staff Journal.

ASSOCIATE -- To relate a package of sorted information to other information in the same or allied class. Example: Is the 1st Battalion of the 32d Tank Regiment part of the 20th Guards Tank Division?

SORT -- To arrange entire messages or segments of messages according to a predetermined classification scheme. This is the lowest level process requiring some perception of message content -- at least at the level of the classification scheme. Example: Extracting unit location from a SITREP.

AGGREGATE/ORGANIZE -- To combine associated information and array/display it in a manner that facilitates the decision processes. Example: Update the Order of Battle.

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[11] Cherry, Cullin, On Human Communication, John Wiley & Sons, Inc., New York, 1957.

PROCESSED (PERCEIVED) DATA BASE -- The information used for the decision processes as the best estimate of or surrogate for ground truth.

INTERPRET/VALIDATE -- To hypothesize cause and effect relationships between ordered sets of information and to assess the probability of their correctly representing ground truth. Since ground truth is usually not accessible, validity must be assessed in terms of consistency with past experience, or against independently derived hypotheses from within or outside the group. Example: How can the 2/31 Battalion continue to advance at over 5 km/hr against two regiments when it has sustained a reported 60 percent casualties?

EVALUATE/COORDINATE -- To determine whether the perceived situation warrants consideration of taking further action or of sharing the perception with another command control group or both. Example: Does the gap apparently opening up on our right flank warrant issuing a frag order, or notifying the adjacent unit, or both?

PROJECT/EXTRAPOLATE -- To estimate probable future situations based on current or predicted trends. Example: Where and when must I lay on the next ammunition resupply operation if present expenditure and movement rates continue?

GENERATE ALTERNATIVES -- To postulate alterr.tive courses of action (for friendly and enemy, offensively and defensively) which could conceivably lead to mission accomplishment. Enemy missions must usually be inferred or multiple missions within his capability must be considered. This latter process is usually referred to as "determining enemy capabilities."

DECIDE -- The process of determining which of the alternatives considered is most likely to yield the "greatest success" in accomplishing the assigned mission.

ASSOCIATE (POST-DECISION PROCESSING) -- To relate fully processed information during preparation of output messages and to update impacted data bases. Example: The decision "main effort on the right" might be transformed into "2d Brigade attacks in zone, makes main effort . . . priority of fires to 2d Brigade."

REAGGREGATE -- To combine fully processed and relevant, needed information into preparation of an output message. Example: Revise the Organization for Combat in accordance with the decision.

SORT (POST-DECISION PROCESSING) -- To arrange segments of an outgoing message ir the selected format and to determine distribution.

TAG (OUTPUT PROCESSING) -- To affix an identifier to an outgoing message to facilitate retrieval from the raw data base.

TRANSMIT -- The process of entering the string of signs or symbols that constitute the message into the external information stream.

VERIFY (OUTPUT PROCESSiNG) -- The same as for input processing.

3.4.2   Process Sequence

The sequence of arrows in Figure 3-3 shows the postulated information flow in carrying out these processes to include data storage and retrieval in the indicated files. The reader may well wonder in comparing Figures 3-2 and 3-3 why there is no arrow leading directly from preprocess to the decision processes. The reason is that the decision processes seem to be triggered far more as a result of scanning the updated perceived data base than by the performance of the pre-processes. Even in those cases where the arrival of an important message, e.g., a frag order, inevitably involves the decision processes, the latter are not invoked until after the newly arrived message has been placed in the context of the perceived data base through pre-processing.

The sequence of decision processes indicated in Figure 3-3 cannot be interpreted too rigidly at this time. As indicated earlier it is only by observing the internal information transfers within the staff group that these processes can be observed separately. The breakdown into processes and their sequence display in Figure 3-3 is based on limited observations in this and previous studies[4,5,12] and must be treated as a hypothesis still to be tested. Furthermore, this sequence can be observed if and only if an observable information transfer in fact takes place between successive processes. When a series of processes is performed by a single individual there is, of course, no way of ascertaining the sequence in which they are performed or whether they have

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[4] Op. cit.

[5] Op. cit.

[12] Tiede, R., et al., The Integrated Battlefield Control System (IBCS) Third Refinement Study, McLean, VA, SAI: Final Report, March 1975.

been performed at all. This is made even more difficult by the fact that a single individual performing a series of these processes will depend far more on his memory than on the formal data base for his processed information, thus further reducing the observable data transfers.

There is ample opportunity in the command control group for such preemption of the formal decision process sequence by the more senior individuals. The following division of labor is frequently observed: decision processors (senior officers), pre- and post-decision processors (junior officers and NCOs), and input and output processors (telephone and radio operators and journal clerk). If a decision maker answers the telephone, he may give a response which has circumvented the entire set of decision processes, or, more likely, they have all occurred within his mind using only his memory as a data base. Even more frequently, a decision maker will overhear an incoming message, glance at a display such as the SITMAP, think for a moment, and trigger the post-decision and output processes by dictating a frag order to an NCO.

It is clear from the above examples that the decision processes are the ones most often performed uninterruptedly by a single individual and are, therefore, the most difficult to discern. In this connection it is interesting to observe the parallelism between the sequence of decision processes postulated in Figure 3-3 and the steps of the decision technique taught in the military service schools. This technique is usually referred to as the Estimate of the Situation.[6] The culmination of this process is the Commander's Estimate. Figure 3-4 shows that the basic sequence is exactly the same and that, indeed, the estimate may provide a basis for further subdivision into even finer processes. This should be investigated in subsequent observations.

As was also indicated earlier, there is not a one-for-one re-lationship between inputs and outputs. Numerous inputs get no farther than the first three or four decision processes -- or even the pre-decision processes -- and are used only to update the data bases, to include the waste basket, without triggering an immediate output. This in no way indicates that such updating of the data base is trivial. On the other hand, many outputs appear to be triggered spontaneously and cannot be traced to any specific input. These may be the result of the continuing background processing going on with respect to the data base and represent reactions to associations not made earlier. Others may, however, indicate the generation of initiatives rather than knee-jerk reactions to individual stimuli. Such initiatives are frequently of the kind in which the decision maker seeks to reduce uncertainty by taking an action which restricts his opponent's freedom of action so that the opponent's actions, in effect, become predictable. Such decisions are clearly in the domain of what Streufert terms "Complexity Theory."[13] A

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6 Op. cit.

13 Streufert, Siegfried and Susan, Decision Making in Complex Tasks, Technical Report #3, PA State University, College of Medicine, Hershey, PA, May 1981.

DECISION PROCESSES STEPS IN THE ESTIMATE

ANALYSIS

Interpret/Validate   Mission Analysis

Evaluate/Coordinate   Area of Operations Analysis

Enemy Situation Analysis

Project/Extrapolate ⟶ Own Situation Analysis

Relative Combat Power Analysis

SYNTHESIS

Generate Alternatives ⟶ Define Enemy Capabilities

Define Own Courses of Action

Analysis of Opposing Courses of Action

Decide ⟶ Comparison of Own Courses of Action

Decision

FIGURE 3-4. DECISION PROCESSES IN THE ESTIMATE OF THE SITUATION

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model such as this may provide a basis for searching for behavior, non-procedural as well as procedural, that is associated with such decision making in order to augment the measures proposed by Streufert.

3.4.3   Human Skills

Having defined a set of information processes performed in a command control group, one can examine the skills needed to perform these processes in the manual mode. A proposed listing of required skills is shown at the row headings of Figure 3-5 which relates those skills to the previously defined information processes. These skills were selected and arrayed on a basis of increasing complexity and so that the successively higher level processes involve all lower level skills. This permits arraying the skills so that the lowest comprise the Level 1 skills required for the input and output processes. The pre- and post-decision processes require Level 2 skills as well as Level 1 while the decision processes require all three levels. Level 1 begins with such elementary skills as see, listen, and point. These have been included because non-verbal as well as verbal skills must be considered in any study of group behavior. As an example of this consider that a trained military observer, even though he understood not one word of English, could, after a short time in one of our command posts, tell whether we were winning or losing the battle. The next four skills (speak, comprehend speech, read and write) refer only to the ability to manipulate strings of symbols that comprise a message. They <u>do</u> <u>not</u> refer to the ability to associate meaning with the symbols. Receiving, transmitting, and verifying manually encrypted messages is the perfect example of the skills referred to here. Thus defined, manual encryption and description are reading and writing skills. Because of the previous definition of "tag" no skills higher than Level 1 are required as long as tagging means simply the assignment of a unique identifier to a complete message, usually in sequential order.

It is only when we reach Level 2 skills required for the pre-decision processes that perception of message content is necessary. Even here, the perception need be at no deeper level than that of the sorting or filing scheme to be used. This has profound implications when we consider automation of these processes as is discussed in the next section. The skills of entering (file, post, plot) and retrieving data from data bases round out the sorting process. Associate and aggregate/organize add a requirement for calculating and composing. Since these processes should not add new information to the stream they are reformulations of data elements already in the data base.

All of the decision processes require all of the Level 3 skills. This may not be immediately apparent until one realizes that any <u>one of the five decision processes can generate an output message</u>. For <u>example, the process of interpret/validate can require the skills</u> needed to answer questions such as, "Who is in a position to know ground truth with reference to this? Who can report ground truth most quickly and with required detail? How shall I send the query? Who needs copies?"

FIGURE 3-5. HUMAN SKILLS VS COMMAND CONTROL PROCESSES — COMMAND CONTROL FUNCTIONS vs REQUIRED SKILLS

REQUIRED SKILLS	INPUT PROCESS			PRE-DEC PROCESS			DECISION PROCESS					POST-DEC PROCESS			OUTPUT PROCESS		
	RECEIVE	VERIFY	TAG	SORT	ASSOCIATE	AGGREGATE/ORGANIZE	INTERPRET/VALIDATE	EVALUATE/COORDINATE	PROJECT/EXTRAPOLATE	GENERATE ALT'S	APPLY (DECIDE)	ASSOCIATE	REAGGREGATE	SORT	OUTPUT TAG	TRANSMIT	VERIFY
LEVEL 3																	
Weigh Alternatives							✓	✓	✓	✓	✓						
Construct Alternatives							✓	✓	✓	✓	✓						
Think							✓	✓	✓	✓	✓						
LEVEL 2																	
Compose					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Calculate				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Retrieve				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
File/Post/Plot				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Perceive				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
LEVEL 1																	
Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Comprehend Speech	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Speak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Point	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Listen	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
See	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Non-Verbal / Verbal

FIGURE 3-5. HUMAN SKILLS VS COMMAND CONTROL PROCESSES

Similar considerations apply to all the other decision processes. The post-decision and output processes are exact parallels of the pre-decision and input processes insofar as their relation to skills is concerned. The result is the distribution shown in the matrix representation of Figure 3-5 which resembles a truncated Gaussian distribution.

Such a model of command control group behavior and the associated skills may be especially useful in developing the diagnostics needed to associate operational deficiencies with the specific skills requiring remedial training. The author admits that the skill identified as "think" may not provide much diagnostic help until it is better defined. At the very least it requires a much deeper understanding of message content than the Level 2 skill "perceive."

3.4.4 Relation to Critical Elements

Having set forth a model of C^2 group information processing in the preceding section, it is appropriate to relate such a model to the critical elements of C^2 activity previously defined and derived from the ARTEPs. It will be recalled that in para 3.3.1 we pointed out that ARTEP tasks and subtasks were directives that specify who is responsible for which processing of what kinds of information. This same format was carried to a higher level of resolution in breaking the ARTEPs down into sub-sub-tasks or critical elements. The action verbs in these directives describe or imply a series of information processes. The verbs in themselves are not very precise and must be considered in the context of the object system-related class of information on which they operate in order to infer a set of required information processes. This was done for the set of critical elements listed in Appendix C. The action verbs were first identified (after making necessary semantic adjustments, e.g., "make a plan" or "prepare a plan" was converted to "plan;" "emplace (sensors)" was modified to "direct (the emplacement of sensors)" since the division G2 rarely emplaces sensors personally). This resulted in a list of 41 action verbs. Each verb was then combined on a card with the object of each sentence in which it appeared in Appendix C. This was done to ensure that the action verb was considered over the entire range of its applications in the ARTEP and the doctrinal literature that elaborated on the ARTEP. The verbs were then arrayed against the five information functions and the included 17 information processes of the model. The resulting matrix is shown in Figure 3-6. The matrix clearly shows that these 41 action verbs, in the context used in the doctrinal literature, can be mapped into the 17 information processes developed from an entirely different set of considerations for Objectives 1 and 3. In a very real sense, these 17 processes are the procedural components of the critical elements.

It is also interesting to observe that Figure 3-6 facilitates grouping the action verbs into five distinct classes as follows:

● Group I: Involves only lower level input and pre-process, i.e., non-cognitive processes.

	ARTEP ACTION VERBS	INPUT			PRE-PROCESS			DECISION					POST-PROCESS			OUTPUT		
		RECEIVE	VERIFY	TAG	SORT	ASSOCIATE	AGGREGATE/ORGANIZE	INTERPRET/VALIDATE	EVALUATE/COORDINATE	PROJECT/EXTRAPOLATE	GENERATE ALTERNATIVES	APPLY (DECIDE)	ASSOCIATE	REAGGREGATE	SORT	OUTPUT TAG	TRANSMIT	VERIFY
I	COLLECT	X	X	X	X													
	RECEIVE	X	X	X	X													
	RECORD	X	X	X	X	X												
	MAINTAIN	X	X	X	X	X	X											
	UPDATE	X	X	X	X	X	X											
II	INTERPRET	X	X	X	X	X	X	X										
	INTEGRATE (INTEL)	X	X	X	X	X	X	X										
	EXAMINE	X	X	X	X	X	X	X	X	X								
	ANALYZE	X	X	X	X	X	X	X	X	X	X							
	ADVISE	X	X	X	X	X	X	X	X	X	X	X						
	TRANSLATE	X	X	X	X	X	X	X	X	X	X	X						
	DESIGNATE	X	X	X	X	X	X	X	X	X	X	X						
	ESTABLISH	X	X	X	X	X	X	X	X	X	X	X						
	DEFINE	X	X	X	X	X	X	X	X	X	X	X						
	ESTIMATE	X	X	X	X	X	X	X	X	X	X	X						
	IDENTIFY	X	X	X	X	X	X	X	X	X	X	X						
	EVALUATE	X	X	X	X	X	X	X	X	X	X	X						
	PLAN	X	X	X	X	X	X	X	X	X	X	X						
	RECOMMEND	X	X	X	X	X	X	X	X	X	X	X						
	DETERMINE	X	X	X	X	X	X	X	X	X	X	X						
	MONITOR	X	X	X	X	X	X	X	X	X	X	X						
	REVIEW	X	X	X	X	X	X	X	X	X	X	X						
	REVISE	X	X	X	X	X	X	X	X	X	X	X						
III	INTEGRATE (PLANS)								X	X	X	X	X	X	X	X	X	X
	ISSUE											X	X	X	X	X	X	X
	DIRECT											X	X	X	X	X	X	X
	DEVELOP											X	X	X	X	X	X	X
	PREPARE											X	X	X	X	X	X	X
	PROVIDE											X	X	X	X	X	X	X
	SUBMIT											X	X	X	X	X	X	X
	FURNISH											X	X	X	X	X	X	X
	INCORPORATE											X	X	X	X	X	X	X
	COMPILE											X	X	X	X	X	X	X
IV	INFORM												X	X	X	X	X	X
	DISSEMINATE												X	X	X	X	X	X
V	REQUEST	X	X	X	X	X	X	X	X				X	X	X	X	X	X
	COORDINATE	X	X	X	X	X	X	X	X				X	X	X	X	X	X
	ENSURE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	REGULATE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	REORIENT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SUPERVISE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

FIGURE 3-6. RELATION OF CRITICAL ELEMENT ACTION VERBS TO MODEL FUNCTIONS AND PROCESSES

- Group II: Involves a series of processes that include decision-making processes.

- Group III: Involves a series of processes that begin with decision making and carry through the lower level post-process and output processes.

- Group IV: Involves only post-process and output processes.

- Group V: Involves the whole range of processes from input through output.

While a few of the verbs that appear in the same group appear to be very nearly synonyms, many are clearly not synonyms in normal usage. Still, the flexibility of the English language permits them to be used very nearly synonomously in the doctrinal literature.

3.4.5   Performance Measures and Standards

The third pillar needed for the development of a set of diagnostics and a training packet is a set of performance standards. Standards are, however, inseparable from measurements, so it is appropriate to examine the conceptually measureable variables in an information system as well as means for their measurement. Six classes of measureable variables have been defined for information systems.[13] These are:

- Numbers of personnel and equipment

- Effort required to carry out selected information process

- Time delays associated with carrying out selected information processes

- Completeness of selected information sets

- Accuracy of selected information sets

- Validity of selected information sets

Of these, the first two provide measures of size, cost, loading factors and utilization. The last four provide measures of the quality of information processing at selected points within the C^2 group and at its output.

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[13] Tiede, R. V., On the Analysis of Ground Combat, Military Affairs/ Aerospace Publishing, Manhattan, Kan., 1978.

3.4.5.1 Definitions

To measure the six variables identified above, it is necessary to define precisely what is to be measured. The above variables are defined for this purpose as follows:

- Personnel and equipment involved can be measured directly.

- The effort required can be measured in man-hours of personnel effort required to perform the information processes needed to carry out specified functions such as maintenance of a specified file or preparation of a specified output.

- Time delays can be measured in terms of the time (usually in minutes) required to perform the information processes needed to carry out specified functions just as in measuring effort.

- Completeness of selected information sets can be measured by the presence or absence of the data elements specified to be included in the set. This implies a standard of measurement against which this count will be made, and this is established below.

- Accuracy of selected information sets can be measured by comparing corresponding data elements of the selected set with the standard set. Data elements that do not match exactly are in error. This measurement standard is also discussed below.

- Validity of selected information sets is defined as the combination/intersection of the truth of the information, as compared to ground truth, and its relevance to the decision for which the information set has been assembled. This quality of information cannot be measured directly in real systems, except on a basis of experience with real or synthetic systems as will be pointed out below.

3.4.5.2 Points of Measurement

Having defined the variables to be measured, it is necessary to look for the appropriate points within the system at which measurements can be made. Numbers of people and equipment pose no problem because this measurement is a property of the C^2 system structure being investigated and not its performance. The other five variables, however, are true performance measures, and it is necessary to determine points at which or between which these variables are to be measured. The considerations portrayed in Figure 3-3 pertaining to the nature of the data transformations in a tactical CP are pertinent to this determination.

This concept has been redrawn in Figure 3-7. Points at which measureable data sets exist (data inputs, files, and direct outputs) have been identified by marking them with letters a, b, and c. The input sets, files, and data extracts have been marked a to denote that data elements in these sets should be unaltered by any processing between these points. Data aggregations have been marked b to indicate that data elements contained in this class of data sets can be altered between input and output but only to the extent that output data elements can be objective combinations of input elements. Objective is defined to mean an a priori rule for combinations already stored in the data base. Outputs marked c, however, contain subjective combinations of input data elements (combinations not stored in the data base in advance) and new data elements not contained in the data base. Data sets of class c result from human decision making. The formal command/staff outputs of the decision-making node are shown along the lower tier of Figure 3-7. They consist of combinations of the direct output that can be designated as purely of class a, b, or c. Appropriate bases for measurements at each of the identified measurement points can now be established.

3.4.5.3 Bases for Measurement

Appropriate bases for measuring each of the measureable products are summarized in Table 3-2.

- Delay time and effort can both be measured between the inputs and the files. Such measurements provide information on the delay times between inputs and the files (especially visible files) and on the file maintenance effort. For data extracts, both can be measured either between input and extract or between file and extract -- whichever is more appropriate. For the remaining output products (aggregations, estimates, decisions, and recommendations), both delay time and effort are measurable between the file and the respective output. A measurment between outputs of this type and input is not, in general, possible because the identity of the original input data elements has been lost.

- Completeness of files, data extracts, and data aggregations is directly measurable by comparison with inputs. On the other hand the completeness of estimates, decisions, and recommendations is not measurable in terms of inputs since they contain data elements not necessarily all derived from the data base. Their completeness can therefore only be measured on a basis of experience (checklists), by counting the number of requests for clarification submitted by the recipients of such outputs, or in terms of combat outcomes.

FIGURE 3-7. NATURE OF THE DATA ELEMENT TRANSFORMATIONS AT POINTS IN THE DECISION-MAKING NODE
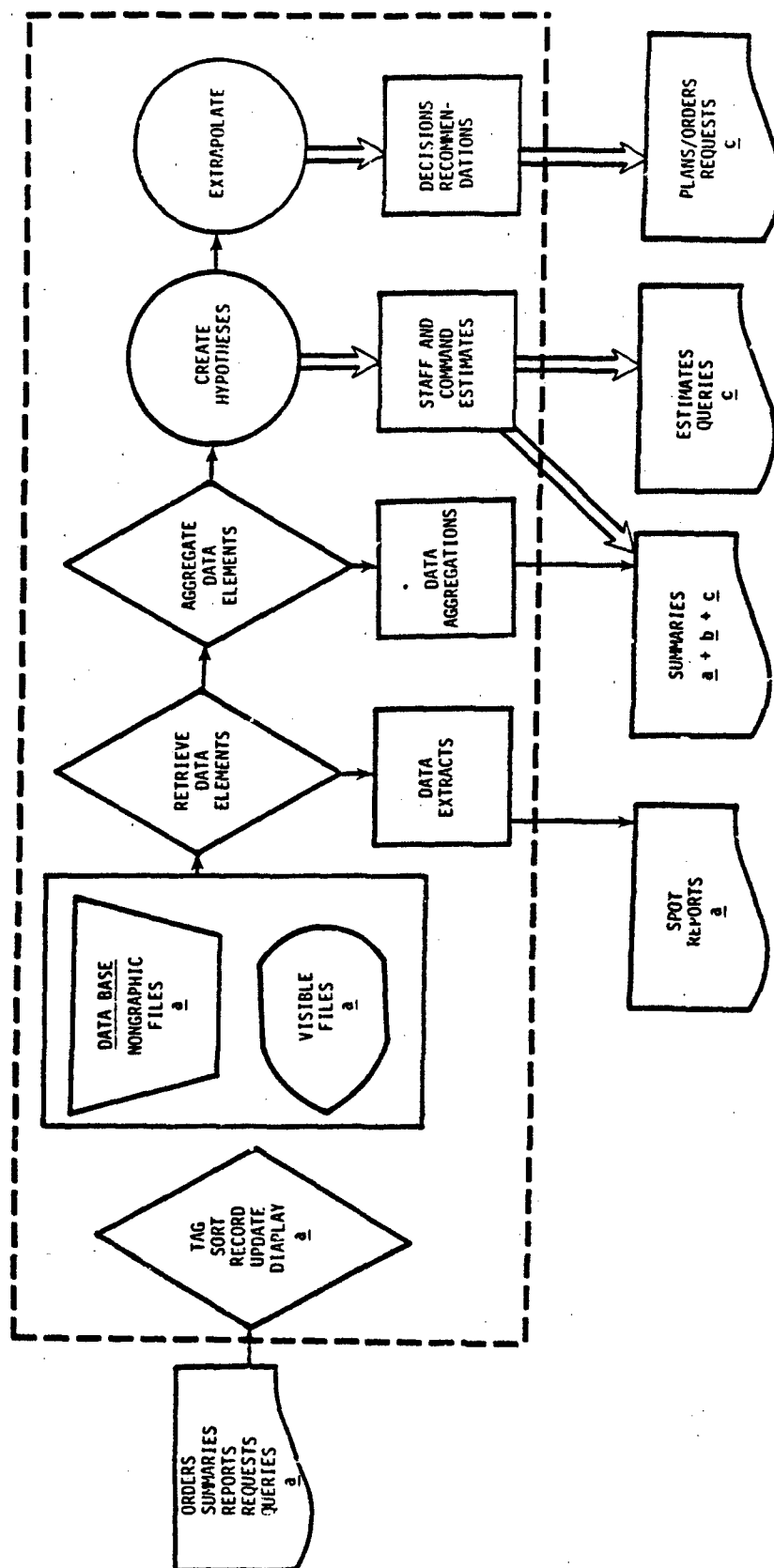
Subjective Combinations ⟶ Objective Combinations

a Data elements at these points unchanged from input.

b Data elements are objective combinations of input elements.

c Data elements here are subjective combinations if input.

TABLE 3-2. BASES FOR MEASUREMENT

MEASURABLE PRODUCT (point of measurement)	EFFORT AND DELAY MEASUREABLE BETWEEN	MEASUREMENT STANDARD FOR		
		COMPLETENESS	ACCURACY	VALIDITY
Files, Visible and Nongraphic, a	Input and File	Input	Input	Experience
Data Extracts, a	Input and Output or File and Output	Input	Input	Experience
Data Aggregations, b	File and Output	Input	Input	Experience
Estimates, Decisions, Recommendations, c	File and Output	Experience, Requests for Clarification, and Combat Outcomes	Experience, Combat Outcomes	Experience, Combat Outcomes

- Accuracy of files, data extracts, and data aggregations can also be measured by direct comparison with inputs. The accuracy of estimates, decisions, and recommendations, however, can be based only on experience or combat outcomes for the same reasons as for completeness.

- The validity of the decision node outputs is not directly measurable within the information system itself. Since, by definition, validity depends on comparing the truth of information with ground truth, this factor can be measured only with respect to the physical phenomena that lie beyond the sensors originating the information at the peripheries of the information system. The other factor entering into validity of information is its relevance to the decision made. This is a subjective determination in real systems and is impossible to disentangle from the validity of the decision. Only the physical results of decisions are measurable physical quantities, and these again lie outside the confines of the information system. It is this factor that indeed requires an effectiveness model, i.e., a simulation, to relate information system performance to combat effectiveness. Any attempts at direct measurement of the validity of information outputs or of files can, therefore, be based only on experience.

3.4.6   Division-Level Staff Actions

The discussion now turns to the identification of the staff actions associated with a division-level command group. The material in the preceding paragraphs describing staff actions as structured sequences of information processes and outlining the staff performance measures to be used in the execution of staff actions applies to command groups at all echelons from corps down to task force/ battalion. However, the names and formats of staff inputs and outputs, the nominal times to complete individual elementary operations, and the size of individual staff sections all vary over a wide range across the four echelons. If one compares, for example, the staff action at TF/Bn-level related to the preparation of the intelligence paragraph of the situation report with the staff action at corps level related to the preparation of the Periodic Intelligence Report (PERINTREP), one will find that the same sequence of information processes is performed by the Bn S2 or by the Corps G2 Section. But the Bn S2 will ordinarily complete his staff action in less than 5 minutes (by making grease pencil entries on the situation map) so that the Bn S3 can submit the situation report by radio telephone. The intelligence paragraph is reported verbally by summarizing the enemy situation indicated on the map. In contrast to this, the preparation of the PERINTREP at Corps might take the G2 Section three to six hours to complete. The report is a formal typed document, and the "SYNTHESIZE DATA" elementary operation will entail the integration of

intelligence information from subordinate division INTSUMs and a number of other sources. In this comparison or any other made of like staff actions across the echelons, the manifest nature of the actions will be widely different, but the sequence of information processes involved and the classes of measurement of human performance standards remain the same.

Since the diagnostic development effort requires knowledge of the staff action timing which does vary widely across the echelons, this report presents separate tables giving the identification and character-ization of staff actions used at the four different echelongs. It is noted that the discussion of staff actions has focused on division-level command/staff groups. Moreover, the staff action tables to follow are fairly complete for division while at the other echelons only representative subsets of the total sets of staff actions are provided. This emphasis on division derives from the extensive data base generated through pre-vious research efforts on the division-level C^2 system, which provided the basis for the division staff actions shown below.

The division-level staff actions are shown in Tables 3-3 thru 3-9. In accordance with the scope outlined in the research plan, the seven tables cover the seven staff sections or elements making up the division-level command group and staff, as follows:

- Table 3-3 gives the staff actions of the Command Group.

- Table 3-4 gives the staff actions of the G1 Section.

- Table 3-5 gives the staff actions of the G2 Section.

- Table 3-6 gives the staff actions of the G3 Section.

- Table 3-7 gives the staff actions of the G4 Section.

- Table 3-8 gives the staff actions of the Fire Support Element (FSE).

- Table 3-9 gives the staff actions of the Division Airspace Management Element (Air Defense).

These division-level tables and the tables to follow for other echelons all have the same format and column headings. The key element giving absolute identification to a staff action entry in the tables is the "reference number" given in the first or lefthand column in the general format. The numbering system and the other column headings are described briefly in the following paragraphs.

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TABLE 3-3
STAFF ACTIONS IN COMMAND GROUP

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL EVENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D001	Mission Restatement by Commander	3		I		Receipt of Mission (thru G3)	End of Briefing	CG guidance to G1, G2, G3, G4 FSE, ADE.	(None)	-
D002	Commander's Decision	3		I		Receipt of the estimate	Selection of C/A	CG decision to G1, G2, G3, G4 FSE, ADE	(None)	-
D003	Approval of Plans & Orders	3		I thru VII		Receipt of draft plans or orders	Approval	CG approval to staff section that submitted	(None)	-
D004	Internally-Initiated Action	4		I thru VII		Self-initiated	Xmssn of • Query • Orders	(None)	Xmssn copy if it exists	Query addressee and/or action addressee
D005	Processing of Query Response	1		I thru VII		Receipt of query response	Xmssn of orders	Info copies to all staff elements	Xmssn copy if it exists	Action addressee
D006	Issue Nuclear Release Request	3		III		Receipt of draft request (from G3)	Xmssn of request	Info copies to all staff elements	Xmssn copy, if it exists	Corps

TABLE 3-4

STAFF ACTIONS IN G1 STAFF SECTION

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEES
D101	Preparation of Personnel Estimate	3		I	Ia102 - Ia106 Id110 - Id114 Ie119 - Ie120	Receipt of CG guidance	Xmssn, delivery to G3	To G3	(none)	--
D102	Preparation of Personnel Annex	3		I	(same as D101)	Receipt of CG guidance	Xmssn, delivery to G3	To G3	(none)	--
D103	Processing of incoming Bde/Bn PDS	1		III	III 101,102	Receipt of subord. PDS	Updating of PDS G1 files	To CG, G3, as required.	(none)	--
D104	Processing of rxmttd NBC report	2		III	III 101,102 V 101,102	Receipt of rxmttd copy (from G2)	Updatding G... files, possible xmssn of Frag Order	To CG, G3, as required. To all staff elements.	Frag order (Medevac)	Medevac addresses
D105	Processing of rxmttd Bde/Bn SITREP	2		III	(same as D104) III 103, 104, 105	Receipt of rxmttd copy (from G3)	(same as D104)	(same as D104)	(same as D104)	(same as D104)
D106	Processing of rxmttd CAPE Rpt.	2		III	(same as D104)	Receipt of rxmttd copy (from G4)	(same as D104)	(same as D104)	(same as D104)	(same as D104)
D107	Preparation of Division PDS	6		III	III 101,102 V 101,102	CLOCK/SOP	Xmssn of Div. PDS	Info copies to all staff elements	Xmssn copy	Corps
D108	Preparation of Personnel Request	4		III	III 101 - 105 V 101 - 102	Self-initiated	Xmssn of request	Info copies to all staff elements	Xmssn copy	Corps

TABLE 3-5
STAFF ACTIONS IN G2 STAFF SECTION

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEES
D201	Preparation of Intelligence Estimate	3		I II	All task 1 G2 elements All task 2 G2 elements	Receipt of CG guidance	Xmssn, delivery to G3	To G3	(none)	
D202	Preparation of Intelligence Annex	3		I	(same as D201)	Receipt of CG decision	Xmssn, delivery to G3	To G3	(none)	-
D203	Preparation of Intelligence Collection Plan	3		II	IIb 208 - 214 IIc 220 - 225	Receipt of CG guidance	Xmssn of DICP	Info copies to all staff elements	Xmssn copy DICP	ASAC, Bdes, ACS, Corps.
D204	Processing of Rxmttd Bde SITREP	2		III & IV	III 201 - 207 IIb, IIc IVA201, IVb205 - 213, IVc	Receipt of rxmttd copy (from G3)	Update of ENSIT map, files.	(none)	(none)	-
D205	Processing of incoming combat intel. report	1		III & IV	Same as D206	Receipt of Combat Intel. Rpt.	-Update of ENSIT map, files -possible xmssn of Frag Order (Intel)	-Rxmit copies to CG, G3, or other staff elements -Info copies to other staff elements	(none)	
									xmssn copy	ASAC, Bdes, ACS
D206	Processing of incoming Intel. Spot Reports	1		III & IV	Same as D206	Receipt of Intel. Spot Rpt.	(same as D207)	(same as D207)	(same as D207)	(same as D207)
D207	Processing of incoming Shell Rpt.	1		III & IV	Same as D206	Receipt of Shell Rpt.	(same as D207)	(same as D207)	(same as D207)	(same as D207)
D208	Processing of incoming Bde INTSUM	1		III & IV	Same as D206	Receipt of Bde INTSUM	Update of ENSIT map, files	Rxmit copies CG, G3, other staff elements	(none)	(none)

TABLE 3-5 (Continued)
STAFF ACTIONS IN G2 STAFF SECTION

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASK	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D209	Processing of Incoming EST EN SIR	1		III & IV	Ia 204; Ij 259; IIa203; III205; IVa201; IVb205 - 213	Receipt from ASAC	Update of ENSIT map, files	Rxmit copies CG, G3, or other staff elements.	(none)	-
D210	Processing of Incoming Wea. Forecast	1		I thru IV	Ia 202, 207 IIa 202	Receipt from ASAC	Posting	Rxmit copies to all staff elements	(none)	-
D211	Processing of Incoming Agr. Tgt List (Intel)	1		I thru IV	Ic 212, 213; Id 219; IVb 205	Receipt from ASAC	Posting, filing	Rxmit copies to CG, G3 & GSE	(none)	-
D212	Processing of Incoming PSDR	1		III & IV	IVb 205 - 213; IVc218 III 204, 205	Receipt of PSDR	Update of ENSIT map, files	Rxmit copies	(none)	-
D213	Preparation for Periodic Briefing	6		III & IV		CLOCK/SOP	End of Briefing	(none)	(none)	-
D214	Preparation of Division INTSUM	6		III & IV	Tasks III & IV critical elements	CLOCK/SOP	Xmssn of Division INTSUM	Info copies to all staff elements	Xmssn copy	Corps
D215	Preparation of Intel. para, Division SITREP	6		III & IV	Same as D216	CLOCK/SOP	Xmssn, de-livery to G3	To G3	(none)	-
D216	Processing of Incoming NBC Rpt.	1		V & IV	IVb205 - 213 V 201 - 206	Receipt of NBC Rpt.	If rcrd from Corps: .Update ENSIP map, files If rcrd from subcom: .Update ENSIT map, files .Xmssn to Corps	Rxmit to all staff elements / Rxmit to all staff elements	(none) / Xmssn copy	- / Corps

TABLE 3-6
STAFF ACTIONS IN G3 STAFF SECTION

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEES
D301	Processing the Assigned Mission	1		I	NONE	Receipt of Mission	Notification of Cmdr's briefing	Rxmt Mission to all staff elements	(none)	
D302	Preparation of the Estimate	3		I	Task I elements	Receipt of CG guidance	Delivery of estimate to Cmdr.	Copies of Estimate to all staff elements	(none)	
D303	Preparation of OPLAN/OPORD	3		I	Task I Elements IIc308 - 313	Receipt of CG decision	·Xmssn of warning orders ·Xmssn of frag orders	Info copies to all staff elements Info copies to all staff elements	Xmssn copies if any Xmssn copies	Bdes, Div. troops Bdes, Div. troops
D304	Processing of Incoming Bde/Bn SITREPs	1		III	Task III Elements	Receipt of SITREP	·Update of FRENSIT map files ·Possible xmssn of frag orders	Rxmit to G2, possibly others Info copies to all staff elements	Xmssn copy, if it exists	Rdes, Division troops
D305	Processing of Incoming EN Cont Rpt.	3		III	Task III Elements	Receipt of EN Cont Rpt	(same as D304)	(same as D304)	(same as D304)	(same as D304)
D306	Processing of Incoming UPR	1		III	Task III Elements	Receipt of UPR	(same as D304)	(same as D304)	(same as D304)	(same as D304)
D307	Preparation for periodic briefing	6		III		CLOCK/SOP	End of briefing	(none)	(none)	
D308	Preparation of Division SITREP	6		III	III 301 - 303, 304 -310	CLOCK/SOP	Xmssn of Division SITREP	Info copies to all staff elements	Xmssn copy	Corps
D309	Preparation of Request for Reserves	4		III	same as D308	self-initiated	Xmssn of request	Info copies to all staff elements	Xmssn copy	Corps

Table 3-6 (Continued)
Staff Actions in G3 Staff Section

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEES
D310	Processing of incoming EOB	1		III		Receipt from ASAC	Update of FRENSIT map files. Possible xmssn of Frag Orders	Rxmit EOB to G2, other staff elements. Info copies to all staff elements.	(none)	- / FWMDC
D311	Preparation for Nuc. Fires	4		III		Self-initiated	Delivery of draft Nuc. Release Rqst to CG. Xmssn of NMOs	To CG, G2, FSE	Xmssn copy, if it exists (none)	-
D312	Processing of incoming Nuc. Release	1		III		Receipt of Nuc. Release (from corps)	Update of FRENSIT map, files. possible xmssn of Frag Orders. possible xmssn of modified NMOs	Rxmit to all staff elements. Info copies to all staff elements. Info copies to all staff elements	(none) Xmssn copies Xmssn copies	All affected areas / Bdes, Bns,ACS / All affected units.
D313	Processing of rxmtd NBC Report	2		▶	V 301 - 304	Receipt of NBC Rpt (from G2)	Update of FRENSIT map. files. Possible xmssn of Frag Orders	(none)	(none)	-
D314	(TBD: OPSEC Action)	?		VI		?	?	Info copies to all staff elements	Xmssn copies	Bdes, Bns,ACS
D315	(TBD: EW action)	?		VI		?	?	?	?	?
D316	(TBD: RAP action)	?		VI		?	?	?	?	?
D317	Processing of incoming AD Alert	1		VI		Receipt of AD Alert	Update of FRENSIT map, files. possible xmssn of Frag Orders. Xmssn of ADWS	Rxmit to ADE files. Info copies to all staff elem. Info copies to all staff elem.	(none) Xmssn copies Xmssn copies	- / RDES, Bns, / All tgtd units.

Table 3-7
Staff Actions in G4 Staff Section

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D401	Preparation of CSS Estimate	3			Task I G4 Elements	Receipt of CG guidance	Xmssn, delivery to G3	To G3	(none)	-
D402	Preparation of Service Support Annex	3			Same as D401	Receipt of CG decision	Xmssn, delivery to G3	To G3	(none)	-
D403	Processing of incoming CAPE rpt.	1		III & VII	III 402-407	Receipt of CAPE Rpt.	Update of CSS files. possible xmssn of Frag Orders	Rxmt to G1, possibly other elements. Info copies to all staff elements	Xmssn copies (free order)	Action addresses Info addres affected Bde. Bns.
D404	Processing of incoming Im. Rqst Log Spt	1		III & VII	III 402-407	Receipt of request	(Same as D404)	(Same as D404)	(Same as D404)	(Same as D404)
D405	Preparation of Division Logistics Reports	6		III & VII	III 402-405	CLOCK/SOP	Xmssn of Div. Log.Rpt	Info copy to CG	Xmssn copy	Corp.
D406	Preparation of Im Rqst to Corps	4		III & VII	III 402-405	Self-initiated	Xmssn of request	Info copy to CG	Xmssn copy	Corps

Table 3-8

Staff Actions in Fire Support Element

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D601	Preparation of FS Estimate	3		I		CG guidance	Xmssn, delivery to G3	To G3	(none)	-
D602	Preparation FS Annex	3		I		CG decision	Xmssn, delivery to G3	To G3	(none)	-
D603	Preparation of Preplanned Request for Fire Support	6		I & III		CLOCK/SOP	Xmssn to Corps	Info copies to CG, G3	Xmssn copy	Corps
D604	Processing of Incoming ARTY SITREP	1		III		Receipt of ARTY SITREP (from DIVARTY)	Updates FS files; Possible xmssn of Frag Orders	Rxmt to G3; Info copies to all staff elements	(none); Xmssn copy	-; DIVARTY, ARTY units
D605	Processing of Incoming Tgt List (ARTY)	1		III		Receipt of Tgt List (ARTY) (from DIVARTY)	(Same as D604)	(Same as D604)	(Same as D604)	(Same as D604)
D606	Processing of Incoming Target (INTEL)	1		III		Receipt of Target (INTEL) (from ASAC)	Updates FS files possible xmssn of Frag Orders	Possible rxmt to G2; Info copies to G2	(none); Xmssn copy	-; ARTY copy
D607	Processing of Incoming preplanned or Im. Rqst for Fire Support	1		III		Receipt of Request	(Same as D604)	(Same as D604)	(Same as D604)	(Same as D604)
D608	Preparation of Immed. Rqst for FS to Corps/Adj Div	4		III		Self-initiated	Xmssn to Corps/Adj. Division	Info copies to all staff elements	Xmssn copy	Corps/Adj.Div.
D609	Processing of Incoming FUFS Cap.	1		III		Receipt of Report (from DIVARTY)	Updates FS Files	Rxmt to G3	(none)	-

Table 3-8 (continued)
Staff Actions in Fire Support Element

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENT	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D610	Processing of Incoming EUFS Cap.	1		III		Receipt of Report (from DIVARTY)	Updates FS files	Rxmt to G2	(none)	-
D611	Processing of FS Status Report	1		III		Receipt of Report (from DIVARTY)	Updates FS file	Rxmt to CG, G3	(none)	-
D612	Processing of Incoming Corps Frag Order (NUC Fire Mission)	1		III		Receipt of Frag Order (from CORPS)	?	?	?	?

Table 3-9
Staff Actions in Division Airspace Management Element (Air Defense)

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENTS	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSES
D701	Preparation of Air Defense Estimate	3		–		CG guidance	Xmssn, de-livery to G3	To G3	(none)	-
D702	Preparation of Air Defense Annex	3		–		CG decision	Xmssn, de-livery to G3	To G3	(none)	-
D703	Processing of Incoming Air Defense Engagement Report	1		III & VI		Receipt of AD Engage-ment Report	Update AD Files	Rxmit to G3	(none)	(none)
D704	Processing of Incoming Air Defense Status Summary	1		III & VI		Receipt of AD Status Report	Update AD Files	Rxmit to G3	(none)	(none)

3.4.6.1 Reference number

The staff action reference number adopted for this study consists of a single letter followed by three digits. Examples are as follows:

D103 -- Division-level, G1 Section, 3rd Action.

B205 -- Brigade-level, S2 Section, 5th Action.

T307 -- Task force/Bn-level, S3 Section, 7th Action.

C702 -- Corps-level, Air Defense Element, 2nd Action.

The leading letter is always D, B, T, or C. The first digit following the letter is always coded as follows:

0 - Command Group
(zero)

1 - Personnel/Admin Section

2 - Intelligence Section

3 - Operations Section

4 - Logistics Section

6 - Fire Support Element

7 - Air Defense Element

3.4.6.2 Description of Staff Action

For the purpose of providing a simple, generalized description of individual staff actions, actions are divided into two classifications: those that are triggered by receipt of an input tactical message or document and those that are triggered by some other means. The former are usually described with the words: "Processing of [name of the staff input]." The latter are described with the words "Preparation of [name of staff output]."

It should be understood that the description of the first kind, namely, "Processing of [name of the staff input]," does not provide any clue regarding the nature of any staff outputs that may be generated by the action. Staff actions with this description may result in output frag orders, output queries, or no output at all, depending on the specific content of the input and the perception drawn by the staff element at the time.

3.4.6.3 Action Category

The Action Category column is the category number of the staff action taken from the earlier ARI work.[5] The staff action categories are shown in Table 3-10.

3.4.6.4 Action Type

The Action Type column is blank at this time.

3.4.6.5 Related ARTEP Tasks

This column contains the related ARTEP Task references from Table 3-1.

3.4.6.6 Related Critical Elements

The references in this column are from Appendix C.

3.4.6.7 Trigger Event

The column describes the event that starts the staff action.

3.4.6.8 Concluding Events

The column describes the event(s) that conclude(s) the staff action. Most staff actions involve processes in which two or more staff personnel perform different information processes leading to the conclusion of the actions. The actions are concluded when the last of these information processes is completed.

3.4.6.9 Crossput Requirements

The crossput requirements are the staff coordination addressees.

3.4.6.10 Hardcopy Output

This column identifies the hardcopy output of the staff action, if such hardcopy exists. Printed or handwritten output material forms one type of "indicator" that can be used in a training exercise to evaluate staff performance. Indicators are discussed in paragraph 3.5.8.

3.4.6.11 Addressees

This column identifies higher headquarters/subordinate unit addressees of any staff outputs generated in the staff action. It should be noted that a large number of the staff actions, particularly those associated with mission planning, do not have any staff outputs at all.

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[5] Op. cit.

Table 3-10

STAFF ACTION CATEGORIES

Intersection of Tactical Information Messages and the Staff Modules

Category	Triggered By	No. Actions from Phase 1 Design
1	Receipt of external tactical message from BUG/Corps	33
2	Receipt of retransmitted copy of another section input	78
3	Receipt of action copy, info copy, query answer, and any response except a concurring chops response	192
4	Internally initiated (INITIATE BY SELF)	15
5	Receipt of directive from Commander or concurring chops response	20
6	Initiated by clock/SOP	6
7	Receipt of staff query or request for chops	76
	TOTAL	420

Taken from ARI Research Note 80-39 (see footnote 5)

3.4.6.12 Additional Remarks

The following additional remarks should be made about the staff action tables:

- Relationship of ARTEP Tasks with Staff Actions of the command group. Table 3-3 (Staff Actions in Command Group) exhibits the ARTEP tasks related to each staff action but omits the associated critical elements. The elements were omitted because the establishment of training objectives and application of diagnostics do not apply to the command group. At division-level the command group personnel are specified as the Commander, Chief-of-Staff, and several personal aids of the Commander.

- Critical Elements Omitted for Certain Other Actions. In certain other staff actions, the related critical elements are omitted because nc critical elements appear related to the specific actions. In these cases, the only critical elements are procedural critical elements, i.e., information processes (paragraph 3.4.4).

3.4.7 Brigade-Level Staff Actions

The tables of brigade-level staff actions are not complete at this time. However, the parallelism of staff functions across echelons is illustrated in Table 3-11. This table contains selected staff actions that take place in the brigade command group/staff.

As stated in paragraph 3.4.6, like staff actions at division level and brigade level exhibit manifest differences in the action timing and the scope of the tactical data base with which the actions deal. Generally speaking, brigade-level actions are executed (i.e., completed) in a shorter period of time than are division-level actions. Brigade-level actions involve smaller staff teams, fewer displays, and less paperwork, and a great many of the actions are executed in their entirety through a single two-way radio-telephone conversation.

From the point of view of hardcopy output, brigade-level actions ordinarily provide fewer instances where the tactical message content associated with the staff output exists in printed or handwritten form.

3.4.8 Battalion/Task Force Staff Actions

The tables of battalion/task force staff actions are also incomplete at this time, but Table 3-12 provides the same or analogous, selected staff actions as those given in paragraph 3.4.7. Battalion-level actions are generally executed in a period of time even shorter than those at brigade. The actions involve very small staff sections, very few displays beyond two situation maps, and minimum paperwork.

Table 3-11
Staff Actions in Brigade Level

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENTS	CONCLUDING EVENTS	CROSSPU. REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEES
S1 Section										
B103	Processing of incoming Bn PDS	1		III	III 101, 102	Receipt of Bn PDS	Updating of S1 files	To CG, S3 as required	(none)	
S2 Section										
B204	Processing of rxmttd Bn SITRE?	2		IIIBIV	IIb; IIc; III201, 207; IVa201, Ivb205 213; IVc	Receipt of rxmttd copy(from S3)	Updating of ENSIT map. files	(none)	(none)	
B215	Preparation of Intel para. of Brigade SITREP	6		IIIBIV	All critical elements under tasks IIIBIV	CLOCK/SOP	Handover to ?	To S3	(none)	
S3 Section										
B303	Preparation of Bde OPORDS	3		1	All critical elements of task I & IIc308-313.	Receipt of Bde Cmdr's	XMSSN of warning orders (if required)	Info copies to all sections	XMSSN copies if they exist	Subordinate Bus.
							XMSSN of frag orders	Info copies to all sections	XMSSN copies if they exist	Subordinate Bus.
B304	Processing of incoming Bn SITREP	1		III	All critical elements of task III	Receipt of Bn SITREP	Update of FRENSIT map files / Possible XMSSN of frag orders	Rxmlt to S2, possibly others	(none)	
B307	Preparation of Brigade SITREP	6		III	III301-303, 308-310	CLOCK/SOP	XMSSN of Bde SITREP	Info copies to all sections	XMSSN copy	Div.
S4 Section										
R407	Preparation of Immediate Request for Logistic Support	4		IIIBVII	III402-405	Self-initiated	XMSSN of request	Info copy to Bde Cmdr.	XMSSN copy	Div.

Table 3-12

Staff Actions at Battalion/Task Force

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENTS	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HANDCOPY OUTPUT	ADDRESSEE
S1 Section										
T103	Processing of incoming Co PDS	1		III	III 101, 102	Receipt of Co PDS	Updating of S1 files	To Bn Co, S3 as required.	(none)	-
S2 Section										
T204	Processing of rxmttd Co. SITREP	2		III&IV	IIb; IIc; III201-207, IVa201, IVb 205-213, IVc	...rxmttd copy (from S3)	Updating of ENSIT map, files	(none)	(none)	-
T215	Preparation of Intel para. of Bn/TF SITREP	6		III&IV	All critical elements under III&IV	CLOCK/SOP	Handover to S3	To S3	(none)	-
S3 Section										
T303	Preparation of Bn/TF Plans & Order	3		I	All critical elements of Task I&IIc308-313.	Receipt of Cmdr's Decision	•XMSSN of warning orders (if required) •XMSSN of orders	Info copies to all sections	XMSSN copies if they exist.	Subordinate Companies / Subordinate Companies
T304	Processing of incoming Co. SITREP	1		III	All critical elements of Task I&I	Receipt of Co SITREP	Update of FRENSIT map files •Possible XMSSN of orders	Rxmit to S2, possibly others	(none)	-
T307	Preparation of Bn/TF SITREP	6		III	III301-303, 308-310	CLOCK/SOP	XMSSN of Bn/TF SITREP	Info copies to all sections	XMSSN copy if they exist	Brigade
S4 Section										
T407	Preparation of Immediate Request for Logistic Support	4		III&VII	III402-405	Self-initiated	XMSSN of request	Info copy to Bn Cmdr, if available	XMSSN copy if it exists	Division supply units.

Nearly all actions are executed in their entirety through single two-way radio-telephone conversations. Since virtually all staff outputs except OPLAN/OPORDs are transmitted verbally in these conversations, hardcopy output may or may not exist for after-action review and evaluation. A unit journal recording significant message traffic and decisions and SITREP and INTREP files should be available.

3.4.9 Corps-Level Staff Actions

The tables of corps-level staff actions are also incomplete at this time. Selected staff actions are shown in Table 3-13. These selections parallel the actions shown in Tables 3-11 and 3-12 insofar as possible but they are clearly oriented to corps-level staff responsibilities.

The command group/staff at corps is very much larger than any counterparts at lower echelons. The scope of the tactical information and command responsibilities covered at corps call for larger complements of staff personnel, vastly increased volumes of message traffic, and generally more formal treatment of staff outputs. Unlike lower echelon staff actions, corps-level staff operations provide hard copy records of nearly all aspects of the actions.

This completes the development of the extended staff action model as it stands at this writing. The formal structure is still tentative, and type staff action columns in Tables 3-3 through 3-13 remain blank, pending validation based on further research.

3.5 STANDARDS AND PERFORMANCE DEFICIENCIES

This section discusses the concept of standards and their role in training command control groups/staffs. Two broad categories of standards can be distinguished: those derived from or explicitly stated in ARTEPs; and those which transcend ARTEP scenarios and apply to the performance of the staff in general. This section first discusses ARTEP standards and potential refinements to those standards. The notion of performance deficiencies and their relation to standards is then examined. The section concludes with the introduction of the notion of "indicators," and their role in identifying performance deficiencies.

3.5.1 Refinement of ARTEP Standards

The basis upon which the entire Command Group Training Packet rests is the notion of standards. The establishment of training objectives, the evaluation of staff performance, and the application of diagnostics to pinpoint training requirements, all use standards as the common medium. All of the fundamental concepts upon which subsequent analysis will be based, i.e., critical elements, staff actions, diagnostics and simulation suitability, are either derived from, associated with or measured against standards. While the various ARTEPs and FMs provide general standards regarding task performance and staff responsibilities, the analysis required for the development of the Command

Table 3-13
Staff Actions at Corps Level

REFERENCE NUMBER	DESCRIPTION OF STAFF ACTION	ACTION CATEGORY	ACTION TYPE	RELATED ARTEP TASKS	RELATED CRITICAL ELEMENTS	TRIGGER EVENTS	CONCLUDING EVENTS	CROSSPUT REQUIREMENTS	HARDCOPY OUTPUT	ADDRESSEE
G1 Section										
C103	Processing of Incoming Division PDS	1		III	III101, 102	Receipt of Div. PDS	Updating of G1 Files	To CG, G3, as required	(none)	-
G2 Section										
C204	Processing of rxmttd Div. SITREP	2		III&IV	IIb; IIc; III201, 207; IVa201; IVb205, 213; IVc	Receipt of rxmttd (from G3)	Updating of ENSIT map,	(none)	(none)	-
C214	Preparation of Corps PERINTREP	6		III&IV	All critical elements under Tasks III&IV	CLOCK/SOP	XMSSN of PERINTREP	Info Copies to all staff elements	XMSSN copy	Army Group Command
G3 Section										
C303	Preparation of Corps OPORDs	3		I	All critical elements of Task I & IIc308-313	Receipt of Corps Cmdr Decision	●XMSSN of Warning Orders (if required) ●XMSSN of frag orders	Info copies to all staff elements / Info copies to all staff elements	XMSSN copies / XMSSN copies	Subordinate Division Corps Units / "
C304	Processing of Incoming Division SITREP	1		III	All critical elements of Task III	Receipt of Division SITREP	●Updating of FRENSIT map, files ●Possible XMSSN of frag orders	Rxmit to G2, possibly others	(none)	-
C307	Preparation of Corps	6		III	III301-303, 308-310	CLOCK/SOP	XMSSN of Corps SITREP	Info copies to all staff elements	XMSSN copy	Subordinate Divisions
G4 Section										
C407	Preparation of Immediate Request for Logistic Support	4		III&VII	III402-405	Self-initiated	Xmssn of request	Info copy to Corps Cmdr	Xmssn copy	TASCOM

Group Training Packet demands more specific formulations. Since the statement of work also alluded to possible modifications to existing ARTEPs, it was determined that refinement of the ARTEPs was a high priority during the first year. To this end, an initial refinement effort was undertaken for the division ARTEP, the results of which are provided in Appendix D, and explained below.

The refined ARTEP in Appendix D does not differ in format from the original ARTEP; the refinement is organized according to the same tasks and subtasks given by the existing division ARTEP. One of the purposes of the refinement was to eliminate the "self-evident" nature of the standards which result from highly generalized formulations. This was accomplished through a more specific rewording of the standards in some cases, the decomposition of others into smaller and more detailed statements, and in still other cases standards were added which were deemed necessary for a particular task or subtask.

3.5.2 Classes of Performance Standards

It is recognized that the initial attempt to refine the existing division ARTEP presented in Appendix D is still inadequate to provide the degree of resolution necessary for determining the "who, what and why" in the event a performance deficiency is observed (see paragraph 3.5.3 and 3.6.2). In particular, the following shortfalls have been identified:

-- There is no mechanism for accurately pinpointing the responsible individual(s).

-- The standards rely on the subjectivity of evaluators to gauge staff performance; thus, the evaluation process is subject to wide variations.

-- The standards do not address the issue of procedures; i.e., how an individual or staff processes information and arrives at decisions.

-- The question of measurement broached in paragraph 3.4.5 is left unresolved by current ARTEP formulations. This is an important issue in the development of the diagnostics portion of the Command Group Training Packet.

The diagnostics structure developed from the first-year research and outlined in paragraph 3.6 begins to addreess the first shortfall. The second shortfall was one of the purposes of deriving the set of refined ARTEP standards discussed above. This refinement will continue throughout the second year. The issue of procedures is a most critical one in both diagnostics development and simulation suitability assessment. This shortfall will be a focus for the second-year research effort, and awaits pertinent results from the Objective 1 effort.

In order to address the fourth shortfall, a list of classes of performance standards was developed. This list is given in Table 3-14. These classes are significant because they are defined, for the most part, independently of ARTEP tasks and subtasks; i.e., the standards do not necessarily emphasize the object system-orientation of the staff. Rather, these classes of performance standards incorporate both information processing/decision-making procedures and the "nuts-and-bolts" substance of the required tasks and subtasks. This is in marked contrast to the current formulation of standards provided by ARTEPs, in which only the substance (i.e., object system-oriented) of the staff actions is addressed. In addition, the classes defined in Table 3-14 begin to address the notion of measurement, as it is seen that five of the six variables discussed in paragraph 3.4.5 are also defined as classes of standards.

Defining classes of staff performance standards is useful in diagnostics development in that, as shown below, an individual diagnostic segment will be initiated by a performance deficiency. A one-for-one correspondence exists between performance deficiencies and standards. Thus, diagnostic segments are initiated in effect through a consideration of standards. Given the relatively large number of standards associated with ARTEP tasks and subtasks, it is impractical to develop a separate diagnostic segment based upon each ARTEP standard. Thus, it was desired to define a set of classes of standards which encompass all ARTEP standards. Since each ARTEP standard can be placed in one of the ten classes of staff performance standards, at most only ten individual diagnostic segments need to be developed. Limiting the necessary number of diagnostic segments not only facilitates the analysis and development of diagnostics, but also increases the attractiveness and utility of a diagnostics package to commanders in the field.

3.5.3 Concept of Performance Deficiencies

One of the primary objectives of the research associated with Objective 2 is to provide, as part of the Command Group Training Packet, a feedback mechanism for use by commanders following a training exercise. This "training feedback package" should be self-contained and applicable to any type of training exercise. In addition, the feedback package must serve as a useful and facile instrument for the discretionary use of the commander, such that the commander can implement the feedback package to provide his staff training in various areas, without the pressure of having to "perform" in front of a scrutinizing audience. The opportunity for the commander to experiment "in private" with respect to the training of his staff is important to gaining acceptance of the training packet as well as enabling training objectives to be satisfied.

For such a feedback mechanism to be viable it must be based upon two interdependent concepts: standards of performance and the observance of performance deficiencies. Performance standards are provided by ARTEPs and FMs; however, modifying those standards into a more useful form is one of the tasks associated with Objective 2. Closely associated with performance standards, but actually constituting a constraint on the

Table 3-14. Classes of Staff Performance Standards
(vis-a-vis ARTEP Tasks)

Class		Remarks
I.	Currency of displaying data used in accomplishing task	The displayed data bases associated with individual staff sections are maintained and updated to show information as current as possible.
II.	Accuracy of displayed data base used in accomplishing tasks	Closely related to currency of data base; accuracy means free of data errors through transcription, etc.
III.	Currency of non-displayed data base used in accomplishing task	The non-displayed data bases associated with individual staff sections are maintained and updated to show information as current as possible.
IV.	Accuracy of non-displayed data base used in accomplishing task	Closely related to currency of data base, accuracy means free of data errors through transcription, etc.
V.	Timeliness of staff output	
VI.	Quality of Command Group/ Staff output	Staff capable of performing duties under heavy workloads or disruptions caused by enemy activities.
VII.	Staff coordination	Adequate coordination among staff members; proper integration and supervision of staff activities; maintaining thrust of staff activities toward objectives.
VIII.	Proper information flow procedures	Internal counterpart to staff coordination. Clear, unambiguous addressees. Staff members receive information they should receive (in time).
IX.	Proper output formats	Clear and unambiguous orders/reports. Formats according to prescribed standards.
X.	Completeness of task	All object critical elements associated with the task are covered.

determination of simulation suitability and development of diagnostics, are performance deficiencies. A performance deficiency is defined as a staff performance error or degradation, either immediately observable or derivable after the fact. At the simplest level, performance deficiencies are failures to achieve prescribed standards. However, the notion of performance deficiencies is clouded by several interacting factors: the limited utility of standards promulgated by existing ARTEPs and FMs; the extent to which existing standards are modified as a result of the current Objective 2 research effort; the distinction between errors in procedural and errors in object-system oriented activities (how vs. what); and most important, the "indicators" which allow a performance deficiency to be immediately observable or subsequently derived. Work regarding the first two factors has begun and will continue concurrently with the development of the Training Packet; the distinction between how and what has been discussed in Subsection 3.3 and will be addressed throughout the research effort. The final factor, performance deficiency indicators, warrants a more detailed examination.

3.5.3.1 Performance Deficiency Indicators

A list of performance deficiencies can be developed which outlines all potential performance errors or degradations which a staff can commit. Such an idealized list can be quite comprehensive, particularly if one defines potential performance deficiencies in terms of critical elements and/or staff actions. The level of resolution associated with critical elements and staff actions implies that many errors can be committed by staff members in the course of one mission assignment and execution. At the extreme, there can exist a performance deficiency for each critical element. Given the large number of critical elements identified for division, the identification of performance deficiencies in this manner is unrealistic and impractical.

In addition to the sheer number of potential performance deficiencies, an even more important reason exists for resisting defining potential performance deficiencies in terms of critical elements. Although a performance deficiency associated with an object critical element potentially exists, the actual occurrence of that deficiency may be impossible to observe. Unless highly trained observers are able to closely monitor the staff in action (either on-the-scene or via video taping), or unless the staff can be persuaded to write down everything they do, many if not most performance deficiencies can not be observed or derived. The extreme difficulty in measuring the activities of the staff is the principal constraint in determining and differentiating individual and team, procedural and non-procedural behaviors (the focus of Objective 1). The essentiality of such measurement is attested to by the allocation of first-year time, effort and resources associated with Objective 1 solely to developing a system to measure staff behavior.

The above discussion can be generalized and stated thus: Unless an indication of performance deficiency exists, and is capable of triggering human sensors, potential performance deficiencies cannot be actually observed or derived. This general principle leads to the notion

of "indicators" -- something that indicates a performance deficiency. Indicators are defined as measured data, or expert inferences made from data, regarding Command/Staff performance and combat outcomes. Indicators provide a trigger for diagnostics (Section 3.6) and help to define the nature of training needed. Indicators are an important consideration in determining simulation suitability, as discussed in Section 4.

The definition given above implies two categories of indicators: Outcome (or "board" in the case of simulations) and staff. Outcome indicators are explicit and readily observable, and relate to physical processes (or information which represents physical processes in the case of simulations) occurring within the object system. Examples include "Blue attack is failing," "defense fails" or "shortages occur of critical end items." Staff indicators refer to the information processing and decision-making functions of the staff; i.e., staff indicators provide evidence, in addition to outcome indicators, that something has gone wrong inside the command control "black box." Staff indicators may or may not be independent of outcome indicators. For example, upon observation of the staff during a simulation it is noted that the G2 did not coordinate with the G3 regarding rapidly changing enemy movements. Thus, the G3 file is not properly updated (a staff indicator). Then a staff performance deficiency has occurred (see Table 3-14--VII Staff Coordination). This deficiency may be manifested later in the simulation exercise if a friendly unit is overrun due to unexpected enemy strength (an outcome indicator). The important point is that the staff indicator provided evidence of a performance deficiency (failure to coordinate) long before the consequences were manifested by the simulation outcome. It is emphasized that all indicators developed through this research effort, whether outcome or staff, ultimately are used to identify and isolate staff performance deficiencies. Therefore, two indicators, one outcome and the other staff, may lead to the identification of the same performance deficiency. A complete set of indicators has not yet been developed; a partial list is provided in Section 4.

3.6   DIAGNOSTIC SEGMENTS

Section 3 thus far has documented the methodology and findings to date in the development of a general procedural fault tree. This tree is intended to translate observed performance deficiencies by a command group/staff in a training exercise into specific training requirements for that staff. The development work is proceeding according to the methodology shown in Figure 1-4 and to date specifically has covered steps 1 through 3 in the figure. This concluding subsection now focuses on the remaining methodological steps to be covered in the next two years. The subsection presents two "walk thru" examples of how a diagnostic segment will be derived in the conceptual framework of a stated performance deficiency. The complete family of diagnostic segments, covering the full range of potential performance deficiencies, will then become the collection of "branches" and "limbs" of which the general fault tree is composed.

3.6.1   What is a Diagnostic Segment?

A picture or description of the basic structure of the general fault tree cannot be presented until the constituent diagnostic segments are specified. As stated in Appendix A a diagnostic segment is a sequence of questions pertinent to an observed performance deficiency whose answers point either to an objective conclusion about a performance error or to one or more other diagnostic segments. The sequence of questions in a given segment is always oriented to a single staff element. This element bears some measure of responsibility for the ARTEP subtasks involved and has carried out one or more staff actions directed toward that responsibility. The answers to the questions derived from the indicators which result from actions (or inactions) associated with the simulation exercise. These answers provide one of three possible conclusions:

- The staff element has, in fact, committed the performance error; the staff action phase in which the error occurred can be isolated; the staff members contributing to the staff action phase require additional training.

- The staff element is the element in which the error occurred, but the error was beyond the control of the element; no training requirement is indicated.

- The staff element is not the element in which the error occurred; "look further" under another diagnostic segment.

It should be understood that the last conclusion implies a certain structural arrangement of the general fault tree. Every observed performance deficiency must lead ultimately to one of the first two conclusions; the tree cannot become "locked in a loop" by endlessly pointing to another diagnostic segment.

Two examples of diagnostic segments are presented in the following paragraphs. Both examples stem from a hypothetical division level/ FIRST BATTLE exercise in which the Blue force is attacking, and the attack is failing. The observed performance deficiency is that of a failure to maintain the planned combat (force) ratio.

3.6.2   Diagnostic Segment: Example One

The first example is shown in Table 3-15. This table is organized according to the basic methodological steps given in Figure 1-4, and is intended to illustrate the method to be used in deriving the sequence of questions constituting the diagnostic segment.

If the Blue attack is failing and the observed performance deficiency is that the combat ratio is not being maintained, the staff actions carried out by the Division G3 Section should be the first examined. To this end, the associated ARTEP subtasks, the critical elements, and the staff actions are shown in steps 1 through 3. The step 1 entry

TABLE 3-15.   APPLICATION OF THE DETAILED METHODOLOGY
TO A PERFORMANCE DEFICIENCY DIVISION LEVEL/
FIRST BATTLE

SIMULATION INDICATOR: REMARKS

        Blue actack is failing.

OBSERVED PERFORMANCE DEFICIENCY:

        Planned combat ratio is not
        maintained.

STEP 1   ASSOCIATED ARTEP SUBTASK(S):

        Task IIId - concentrate/ shift   Steps 1 thru 5 are "macro"
        combat power.   diagnostics; step 6 is a
                                                "micro" diagnostic.

STEP 2   ASSOCIATED CRITICAL ELEMENTS:

        CRITICAL ELEMENTS

            301 Maintenance of current   Other object critical elements
        operations appraisal.   are also involved.

            302 Maintenance of current
        situation.

        PERFORMANCE CLASS

            II. Accuracy of display data.   Other performance classes
                                                are also involved.
            VI. Accuracy of non-display data.

STEP 3   ASSOCIATED STAFF ACTIONS:

            D304 Processing of incoming Bde/Bn
        SITREP.

            -- Processing of intelligence
        information from G2.

STEP 4A PERFORMANCE DEFICIENCY:

            Combat outcome indicates gross
        departure from planned combat ratio.

(STEP 4B PLAYABILITY: See paragraph 5.2.2 on
          assessment of FIRST BATTLE simulation
          scope)

STEP 5A SPECIFIC STAFF ACTIONS:

         All those given in step 3 observed
         during exercise period.

(STEP 5B GAME STRUCTURE: See paragraph 5.2.2)

STEP 6A. DIAGNOSTIC SEGMENT: Micro diagnostic triggers.

         1. Was the assessment of Blue combat
         power accurate at the time?

         2. Was the assessment of Red combat
         power accurate at the time?

         3. Did G3 make a cognition error?

refers back to Table 3-1. The step 2 entries refer to Appendix C and Table 3-14. The step 3 entry refers to Table 3-6. The information in the REMARKS column should be noted with respect to these references.

In the discussion to follow, the reader is reminded that the entries in the remaining steps, including the sequence of questions under step 6A, should be understood to be tentative at the time of this writing.

The diagnostic segment consists of three questions pertinent to the observed failure of the Blue commander to maintain his planned combat ratio. The objective conclusions or continuation routing stemming from the answers to these questions are discussed below.

3.6.2.1 Question #1

The first question is "Is the assessment of Blue combat power accurate at the time (of the emerging problem)?" The Division G3 has the basic responsibility for monitoring and assessing Blue combat power. If the answer to the question is "yes," then proceed to Question #2. If the assessment was not accurate at the time, then the Operations Section has failed to maintain a timely and accurate picture of status of its forces. The fault tree must route to another diagnostic segment, this one dealing with performance errors in the maintenance of the operations SITMAP and status boards for the Blue forces.

3.6.2.2 Question #2

The second question is "Was the assessment of enemy combat power accurate at the time?" If the answer here is "yes," then proceed to Question #3. If the answer is "no," then the performance failure must have arisen because the Intelligence Section had failed to provide G3 with accurate and timely evaluations of the enemy capabilities. The fault tree should route to another diagnostic segment, which deals with the G2 Section and its collection, processing, and maintenance of intelligence information. This particular diagnostic segment is presented as the second example in paragraph 3.6.3.

3.6.2.3 Question #3

The third question is "Did G3 make a cognition error?" In the light of the answers to the first two questions, the last question in this segment becomes rhetorical. If the G3 Section has been provided with timely and accurate information on the friendly and enemy combat power, the only logical explanation for the observed performance deficiency must lie in the decision-making phases of those staff actions where the G3 (or the Operations OIC) computes the friendly/enemy combat ratio. The G3, operating with up-to-date status information, must be miscalculating the ratio (or using a poor choice of the ratio inputs). The error source is clearly identified, and the training requirement is thus indicated.

3.6.3 Diagnostic Segment: Example Two

The second example of a diagnostic segment is presented in Table 3-16. The segment developed here is shown with the same format and the same references as the first example, but now deals with the Division G2 Section and its collection, processing, and monitoring of information relative to enemy capabilities.

The diagnostic segment in this example consists of four questions. The segment is evoked whenever the observed performance ceficiency has been traced in the general fault tree to the diagnosis of the Intelligence Section and its subtask responsibilities. The objective conclusions about the observed failure of Blue to maintain its planned combat ratio are discussed below.

3.6.3.1 Question #1

The first question in this segment is "Did the play deny the Division G2 timely intelligence input?" If the answer is yes, then it is clear that the performance error arose because the game design included arrangements to keep the Blue side largely "in the dark" about Red capabilities. This "stacking of the deck" may have served other purposes in the exercise, but the Intelligence Section cannot be judged at fault and no particular training requirement is indicated. The question of mismanagement of resources now arises, but is outside the scope of this discussion.

3.6.3.2 Question #2

The second question is "Was there a time lag due to reporting communications time delays?" This question is a special variation of the first question. If the Division Intel radio net and other communications means were subject to outages, jamming, and inordinate communications time delays, then the performance error arose because these phenomena were (presumably) part of the game design. The Intelligence Section cannot be judged at fault and no particular training requirement is indicated.

3.6.3.3 Question #3

The third question is "Was evaluation of enemy combat power delayed because of improper procedure?" The answer to this question may be difficult to pin down in the framework of the FIRST BATTLE exercise. But if the Intelligence Section has pursued its collection and analysis of intelligence information under an SOP that has built-in bottlenecks in the posting of enemy capabilities for G3, then the Intelligence SOP is the source of error. The G2 Section is at fault, and the SOP under which the section operates should be revised. A "yes" answer clearly identifies the staff section at fault and the nature of the corrective training required.

TABLE 3-16.   APPLICATION OF THE DETAILED METHODCLOGY
                        TO A PERFORMANCE DEFICIENCY DIVISION LEVEL/
                        FIRST BATTLE

SIMULATION INDICATOR: Blue attack is failing.   REMARKS

OBSERVED PERFORMANCE DEFICIENCY:

          Planned combat ratio is not main-
          tained.

STEP 1   ASSOCIATED ARTEP SUBTASK(S):

          Task IVb - Analyze enemy capa-   Steps 1 thru 5 are "macro"
          bilities and probable C/As.   diagnostics; step 6 is a
                                                "micro" diagnostic.
          Task IVc - Disseminate critical
          intelligence.

STEP 2   ASSOCIATED CRITICAL ELEMENTS:

          CRITICAL ELEMENTS

              210 Evaluate enemy situation.   Other critical elements are
                                                also involved.
              211 Evaluate enemy capabil-
                   ities and vulnerabilities.

              212 Estimate enemy intentions.

          PERFORMANCE CLASS

              I.   Currency of the displayed   Other performance classes
                   data.   are also involved.

              III. Currency of the non-
                   displayed data.

STEP 3   ASSOCIATED STAFF ACTIONS:

          D205 Processing of incoming   Other G2 staff actions may be
          Combat Intelligence Reports.   involved.

          D206 Processing of incoming
          Intelligence Spot Report.

          D208 Processing of incoming
          Brigade INTSUM.

STEP 4A   PERFORMANCE DEFICIENCY:

> Division is not reacting to enemy
> reinforcement . . .

(STEP 4B   PLAYABILITY: See paragraph 5.2.2 on
> assessment of FIRST BATTLE simulation
> scope.)

STEP 5A   SPECIFIC STAFF ACTIONS:

> Those in step 3 observed during
> exercise period.

(STEP 5B   GAME STRUCTURE: See paragraph 5.2.2)

STEP 6A   DIAGNOSTIC SEGMENT:

1. Did the play deny the Division G2 timely intelligence input.	Micro diagnostic triggers.
2. Was there a time lag due to reporting commo time delays.	Part of game design; no training requirement indicated.
3. Was evaluation of enemy combat power delayed because of improper SOP?	If part of game design; no training requirement indicated.
4. Was evaluation of enemy combat power delayed because of improper execution of SOP?	

3.6.3.4 Question #4

The last question in this segment is "Was evaluation of enemy combat power delayed because of improper execution of the SOP?" The answer to this question is, as in the case of the last question in paragraph 3.6.2, largely rhetorical. If the Blue attack is failing and the source of the difficulty has been traced through the general fault tree to the point where it is known that the G2 Section has failed to provide timely and accurate information on enemy combat power, then the fault lies with the Intelligence Staff. In particular, the members of the G2 Section who performed the input information processing phases or the output processing phases of the relevant staff actions are at fault. Additional training of that part of the G2 Section is therefore indicated.

3.7   SUMMARY

The preceding discussion of a methodology for diagnostics development has been rather far ranging and has covered a wide variety of related subjects. Figure 3-8 is an effort to draw the various facets of this discussion together by showing the functional interrelation of the principal components of the methodology as follows:

- An initial situation ① provided to a C^2 group ② causes them to develop a tactical plan ③ which will accomplish the assigned mission.

- The initial situation ① and the tactical plan ③ provide the information needed to initiate the simulation ④ which provides feedback to the C^2 group ② and who, in turn, provide additional output to the simulation ④.

- The simulation ④ produces a continuing stream of combat outcomes ⑤; comparison of these with the tactical plan ③ provides indicators ⑥ as to how well the plan, as modified by the C^2 group, is succeeding, e.g., rate of advance, loss rates, etc.

- Comparison of the indicators ⑥ with ARTEP standards ⑦ pinnpoints performance deficiencies ⑧.

- Instrumentation of the C^2 group provides critical element performance measures ⑨. Comparison of the performance of those critical elements associated with the performance deficiencies ⑧ with critical element performance standards ⑩ pinpoints deficient critical elements ⑪. These will identify some needed corrective actions ⑯.
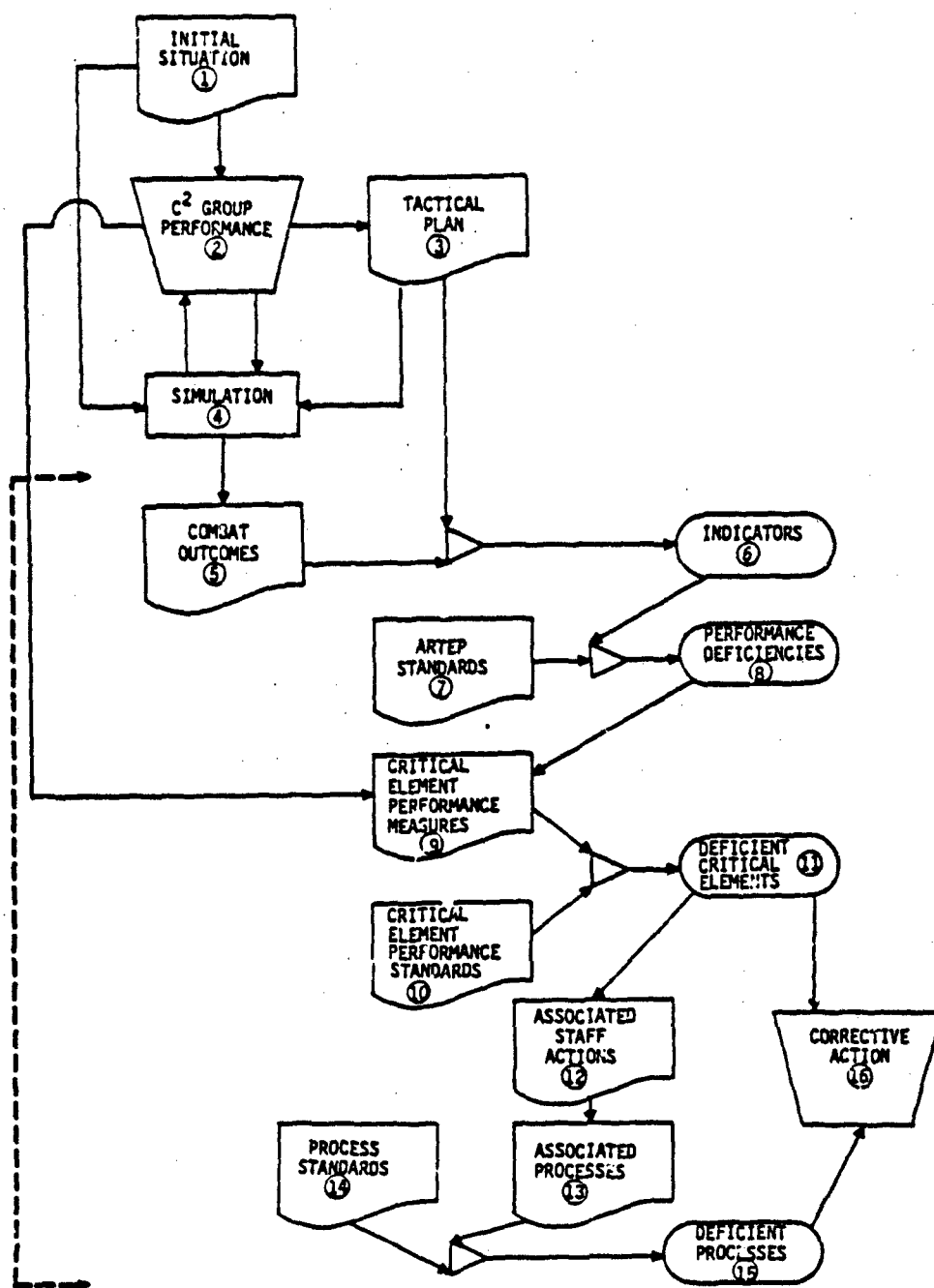
FIGURE 3-8. THE DIAGNOSTIC PROCESS

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- Deficient critical elements ⑪ will identify associated staff actions ⑫ and associated information processes ⑬. Comparison of the latter with process standards ⑭ will identify deficient processes ⑮ which are the basis for further corrective actions ⑯.

The preliminary walkthrough of the diagnostic segments, as discussed in the immediately preceding section, was an effort to outline this sequence from indicators to corrective action insofar as it could be carried out in the present stage of development of the methodology. Clearly, additional work is necessary, to include:

- Development of means for measuring critical element performance and development of critical element performance standards.

- Further development of critical element, staff action, and information process relationships and the establishment of process standards.

The close relationship of the above with the achievement of Objective 1 goals is apparent at this stage and these two efforts will be closely coordinated and integrated during the second year.

SECTION IV

ASSESSMENT OF SIMULATION SUITABILITY

4.1 OVERVIEW

The purpose of this research is to develop strategies and guidance for the use of battle simulations in an integrated fashion in order to provide field units maximum training benefit for resources expended. Training guidance should reflect how each of the simulations examined, as they are now structured, can be best used in training corps through battalion commanders and their staffs to achieve ARTEP standards, and how they can be used concurrently or in some sequential fashion to achieve given training objectives. The problem can be stated in the following manner. How suitable is each battle simulation of interest with respect to the following three characteristics: in developing the outputs needed for comparison with the performance standards established by the ARTEPs (or refined standards generated through this study); for collecting and reducing the data needed for rapid feedback to players; and in providing information with which to pinpoint training deficiencies.

Shortcomings with respect to this last characteristic have already been identified; the only diagnostic information that can potentially be provided by the simulation--as long as all information continues to flow through a human interface--is through the review and analysis of each message emanating from or delivered to each command/staff group element. But the combination of combat outcomes and data package content descriptions provided by the ARTEP actually are the result of a string of information processes. The training deficiencies then lie with either a faulty selection of the processes or sequence of processes, or in faulty execution of the correct processes. The extant simulations do not provide the diagnostics necessary to identify information processing deficiencies to an adequate degree; this particular shortcoming of simulations provided the impetus for the development of a comprehensive diagnostics tool described in the previous section.

Therefore, the assessment of simulation suitability with respect to diagnosing training deficiencies cannot be completed until the diagnostics package is fully developed. An initial assessment of simulation suitability was undertaken with respect to the first two characteristics noted above--developing the outputs needed for comparison with the performance standards provided by ARTEPs and collecting/reducing data needed for rapid feedback to players. The results of the initial analysis are presented in this section. However, as for diagnosing training deficiencies, the complete assessment of simulation suitability with respect to the first two characteristics must await the full development of certain components of the diagnostics, particularly indicators, performance deficiencies and critical elements.

There are two aspects to the notion of simulation suitability (distinct from the three suitability characteristics noted above). The first is the suitability of simulations in rectifying training deficiencies identified through some means (e.g., application of a structured diagnostic tool or the subjective evaluation of an observer). In other words, to what degree does each simulation provide remedial training to those individuals or staff sections in those functional areas pinpointed as deficient, such that those individuals or staff sections will be capable of reaching standards established for those areas? The second aspect is the suitability of simulations in determining the current level of proficiency of the staff and its individual members. Stated another way, can each simulation of interest answer adequately the question posed by the division and brigade ARTEPs, "Where are we now?" This aspect is tied closely with the notion of diagnostics as discussed above. The three suitability aspects given above apply to both aspects; training guidance and strategies developed through this research and incorporated within the Command Group Training Packet must also address both aspects.

The remainder of this section is structured as follows. The scope of extant simulations will be examined in terms of the accommodation of the critical elements derived from ARTEPs and supplemented by FMs. The question of simulation suitability with respect to the determination of staff proficiency in the various command control functions and activities will be examined from the standpoint of indicators of performance deficiencies. Next the suitability of simulations with respect to remedial training will be addressed. The section concludes with a brief look at the relationship between assessment of simulation suitability and the diagnostics.

4.2 SIMULATION SCOPE

The assessment of simulation scope is essentially a first-order analysis which provides answers to the question, "Does each simulation 'play' each critical element?" In other words, are the critical elements accommodated in some way within the simulations such that the staff is provided the opportunity to perform the information processes associated with each critical element and generate an output oriented toward the object system? Since, by definition, each critical element is necessary for the complete performance of an ARTEP task or subtask, the omission of critical elements from the game mechanics associated with a given simulation constitutes a shortfall for that simulation. Thus, in essence, the assessment of the scope of each simulation determines the degree to which ARTEP tasks and subtasks are "played" by the staff players.

As noted in Section 3, the list of critical elements provided in Appendix C was derived for division. Analysis of brigade and battalion tasks and subtasks revealed that the underlying concepts associated with the division critical elements are, for the most part, equally applicable to battalion and brigade. It is noted that differences in orientation (i.e., planning versus direct leading of troops, combat versus combat service support, etc.) and magnitude of the command control functions vary across the three echelons, such that some division critical elements do

not apply to battalion and vice versa. However, for those critical elements which do contain common object system and information processing system processes and data content, the concepts associated can be considered applicable across echelons.

The complete assessment of simulation scope must await the finalized list of critical elements to be developed in the second year. Scope assessment during the first year was therefore limited to selected critical elements. The results of that cursory analysis are provided in Appendix E.

4.3   SUITABILITY OF SIMULATIONS IN DETERMINING STAFF PROFICIENCY

The complete assessment of this aspect of simulation suitability must await the development of the diagnostics, particularly indicators of staff performance deficiencies and critical elements. An initial effort was undertaken to identify potential indicators for the various simulations. As noted in paragraph 3.5.3.1, two categories of indicators were identified: outcome (or board) and staff. Outcome indicators are indications of performance deficiencies manifested by unfavorable outcomes of simulation events, such as a breakthrough by enemy forces. Staff indicators are indications of performance deficiencies through observation of the staff in operation or through an examination of staff outputs such as the OPLAN. Using the critical elements selected for assessment of simulation scope in the previous paragraph, a cursory analysis was performed to determine outcome and staff indicators. The results are given in Appendix E. In addition to outcome and staff indicators, the table provides the associated classes of performance deficiencies drawn from Table 3-14. With the single exception of DUNN-KEMPF, the findings displayed are essentially independent of the particular simulation.

4.4   SUITABILITY OF SIMULATIONS FOR REMEDIAL TRAINING

The assessment of the suitability of simulations from the aspect of remedial training closely parallels the assessment of simulation scope. In order to determine the degree to which a given simulation can provide remedial training, the degree to which that simulation "plays" critical elements must be known. The set of critical elements embodies all of the command control functions and activities which are the responsibility of the staff, with respect to both the information processing system orientation and the object system orientation of the command control system. Thus, any command control functional area in which the staff is evaluated to be deficient can be represented by a particular subset of critical elements. In order for a given simulation to "cover" a specified functional area, and thereby be suitable for remedial training with respect to that area, it must adequately accommodate the complete subset of critical elements comprising that functional area. If particular critical elements are not adequately accommodated within a given simulation, that simulation may require modifications to make it suitable for remedial training in the associated functional areas. Thus, the complete assessment of simulation suitability for remedial training requires the completion of the list of critical elements for each echelon and the completed assessment of simulation scope.

4.5   SUMMARY

Simulation suitability is to be addressed vis-a-vis three characteristics of simulations pertinent to the Objective 2 research effort:

- In providing information with which to pinpoint training deficiencies;

- In developing the outputs needed for comparison with the performance standards established by the ARTEPs (or refined standards generated through this study);

- For collecting and reducing the data needed for rapid feedback to players.

In addition, two aspects of simulation suitability have been identified:

- The suitability of simulations with respect to evaluating staff proficiency in the various command control functions and activities.

- The suitability of simulations with respect to providing remedial training to staff elements upon identification of training deficiencies.

The complete assessment of simulation suitability incorporating these characteristics and aspects must await the full development of the diagnostics. The relationship between assessment of simulation suitability and the diagnostics is illustrated in Figure 4-1. The characteristics and aspects of simulations pertinent to this study have been arrayed in matrix form. Within each of the six cells are listed the components of the diagnostics needed to allow the complete assessment of a given simulation with respect to the aspect and characteristic associated with that cell. Thus, it is seen that the complete diagnostics are needed to assess the suitability of simulations in diagnosing training deficiencies for the purpose of determining the overall proficiency of the staff. By comparison, only the critical elements, staff actions and refined standards are needed to allow the assessment of simulation for the purpose of developing outputs for comparison with standards.

The two cells associated with the last row of the matrix shows that an examination of "game mechanics" is needed for assessing both aspects of simulation suitability with respect to the last simulation characteristic. Such an examination entails an analysis of the structure of simulations to determine "how they work." An initial such examination was performed during the first year and focused on the following: combat results tables, movement of forces on the board, effects of terrain, friendly and enemy force densities, and the concept of zones of control. Of these, the most significant shortfalls of simulations was found to be in the combat results tables. The problems with the tables range from the generation of unrealistic results to nonlinearities resulting in wide variations in damage/kill results. These problems derive from the

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ASPECTS OF SIMULATION SUITABILITY

CHARACTERISTICS OF SIMULATION SUITABILITY

	EVALUATING STAFF PROFICIENCY	PROVIDING REMEDIAL TRAINING
DIAGNOSING TRAINING DEFICIENCIES	Complete Diagnostics Package	Complete Diagnostics Package
DEVELOPING OUTPUTS FOR COMPARISON WITH ARTEP	- Critical Elements - Staff Actions - Refined Standards	- Critical Elements - Staff Actions - Refined Standards
COLLECTING AND REDUCING DATA NEEDED FOR RAPID FEEDBACK TO PLAYERS	- Staff Actions - Game Mechanics	- Staff Actions - Game Mechanics

FIGURE 4-1. RELATIONSHIP BETWEEN SIMULATION SUITABILITY
ASSESSMENT AND DIAGNOSTICS

stochastic processes associated with the determination of hits and kills,
and the use of unclassified information within the tables. The
examination cf game mechanics will continue into the second year.

SECTION V

FINDINGS AND CONCLUSIONS

5.1   FINDINGS

        The principal findings of the first year's research are set
forth below grouped by major task and, therefore, also by section of the
report (see also para 1.4, ORGANIZATION OF THE REPORT).

5.1.1   Data Collection

        Documentation

        ●   Examination of the ARTEPs and FM 101-5, "Staff
             Officers' Field Manual," provided the basis for the
             list of critical elements needed to support the
             development of diagnost·cs, and analysis of simulation
             scope and suitability.

        ●   Previous SAI research efforts provided the basis for
             staff actions and information processes, also necessary
             for diagnostics development and simulation assessment.

        ●   The remaining documents reviewed provided very little
             insight into the use of simulations for training staff
             officers.

        ARTEP Review

        ●   No Corps Command Group ARTEP has been published.
             Several revisions of the Battalion Task Force ARTEP
             71-2 have been attempted but a final draft, ostensibly
             to be published in December 1981, has not yet been
             released.

        ●   Extant Command Group ARTEPs for division and brigade are
             generally consistent in content and format. Differences
             in task organization (i.e., sequence numbers), while a
             seemingly trivial matter, cause undue difficulty in task
             correlation. Draft Battalion ARTEPs reviewed follow a
             totally different format.

        ●   The Division ARTEP provides a useful correlation of
             tasks to staff responsibilities as set forth in FM
             101-5. This specific linkage is not found at the other
             levels.

- "Standards" as set forth in the Division and Brigade ARTEPs are, in actuality, subtasks. Performance standards (e.g., time to complete a subtask) are not defined. One standard does exist -- namely, force ratios to be achieved (ARTEP 100-2).

- Usage and the perceived utility of ARTEPs for command and staff training varied widely among persons interviewed, with, however, general agreement that lack of objectivity was a major drawback. Common usage is as a "checklist."

Field Trip Observations

- The extant simulations are filling definite needs in the field and their use is generally well received, particularly by company grade officers. Usage for other than command and staff training probably dominates usage for that training.

- The most commonly perceived shortcomings are the lack of up-to-date Combat Results Tables and poor integration of logistics play.

- Commanders desire all participants to receive training rather than some (i.e., player-controllers) acting purely as "training aids" for others.

- The Simulation Center concept appears to work effectively. Principal reasons include lessening of burdens on using units, and continuity of expertise, particularly given the diverse structures of the extant simulations.

- Feedback techniques and implementation vary from essentially none to formal critiques and reports. Training versus evaluation implications pertain.

- Computer assistance is being implemented at the local/post level in at least one instance.

5.1.2 Diagnostics Development

The diagnostics package provides the mechanism by which staff performance deficiencies are translated into specific training requirements. Interrelated issues associated with the development of the diagnostics are:

- More specific formulations of standards are needed to provide objective determinations of what actually constitutes a staff performance deficiency.

● In order to observe or accurately discern the occurrence of a staff performance deficiency, simulations must provide adequate "indicators."

● The relationship between ARTEP tasks/subtasks, staff actions, and critical elements must be defined, as these constitute the principal components of a diagnostics segment.

The conceptual structure of the diagnostics package is a set of individual diagnostic segments, each initiated by a class of performance deficiency, the "walk-through" of which identifies the critical element/staff action in which the errors were committed, the responsible individual, and whether those errors were cognitive or procedural.

5.1.3 Simulation Suitability

● Three characteristics of simulations have been identified as key to the assessment of simulation suitability:

   - Providing information with which to pinpoint training deficiencies

   - Development of the outputs needed for comparison with the performance standards established by the ARTEPs

   - Collecting and reducing data needed for rapid feedback to players.

● The suitability of simulations can be viewed from two aspects:

   - The suitability of simulations in determining staff proficiency in the various command control functions and activities

   - The suitability of simulations in providing remedial training to the command staff group.

● The complete assessment of simulation suitability cannot be done until the diagnostics have been fully developed.

● A first order analysis of simulation suitability was performed to determine the "scope" of simulations, in terms of critical elements. It was found that simulations allow all of the critical elements selected for analysis to be "played" by the staff during the course of an exercise.

- The "scope" of a simulation should be considered as encompassing the (player) planning phase as well as explicit board indications of tasks performed.

- Given this definition, the majority of ARTEP tasks are accommodated by the extant simulations. However, careful monitoring of implementation of plan/orders on the playing boards is required to assess training deficiencies.

- Variations in game mechanics and structure between simulations constitute added burdens in terms of preparation time, and/or learning during execution, and thus may detract from training focus.

- Stochastic processes vary from simulation to simulation, causing difficulties in transferability of "lessons learned" when tactical training is an objective.

- Regardless of the training objective OPFOR play is essential, and thus requires particular emphasis.

- The potential for introduction of computer assistance is present in all the extant manual simulations.

5.2   CONCLUSIONS

- There exists a need for common format functional documentation for all extant simulations.

- A single methodology for all simulations from corps to battalion is highly desirable.

- The extant simulations will continue to be used for purposes other than command and staff training. There exists a need to provide guidance as to the impact of simulation limitations for such applications.

- Guidelines are needed for use of ARTEPs in conjunction with extant simulations.

- There is a need for development of specific guidance relating to feedback techniques and procedures.

- Given ingenuity and careful preparation by exercise directors, the scope of the extant simulation appears generally adequate.

- The acceptance of computer assistance will increase at local levels as junior officers familiar with simulations and computer technology advance in rank.

- There is a need for development of guidance for training of staff elements prior to their participation in simulation play.

- Simulation utility can be increased by increasing emphasis on the player planning process preceding actual execution.

5.3   SECOND YEAR FOCUS

As the first year research effort drew to a close, two issues emerged which will be examined during the second year. The first was consideration of the new generation of simulations under development at the time of this writing, namely FIRST BATTLE BATTALION-CORPS, CAMMS II, ARTBASS and MACE. The second issue will be a re-evaluation of the central role played by ARTEPS within the diagnostics; in particular, consideration will be given to focusing more attention on staff actions, and their role within the diagnostics package and the CGTP.

APPENDIX A
DEFINITIONS

CRITICAL ELEMENT   An important activity specified by or derived from
                   analysis of an ARTEP task or subtask. Critical
                   elements are composed of a verb which tells how
                   something is accomplished (i.e., information
                   processing-oriented), and an object which states what
                   must be accomplished (i.e., object system-oriented).

DIAGNOSTICS   A set of guidelines to aid a commander in assessing
                   the causes of staff performance deficiencies (defined
                   below) and in establishing training requirements. It
                   is currently envisioned that the diagnostics package
                   will consist of a set of diagnostic segments, each
                   initiated by a performance deficiency.

INDICATOR   Measured data, or expert inferences made from data,
                   regarding command/staff performance and combat
                   outcomes which indicate a performance deficiency.
                   Indicators provide a trigger for the diagnostic
                   segments and help to define the nature of training
                   needed.

INFORMATION   The elementary components or steps required to carry
PROCESS   out a staff action. Lower and intermediate level
                   processes are usually performed by a single
                   individual. The higher level (cognitive) processes
                   may be carried out jointly by two or more individuals.

PERFORMANCE   A staff performance error or degradation, either
DEFICIENCY   immediately observable or subsequently derived.
                   Performance deficiencies are inseparable from
                   standards, as they are two sides of the same coin.

SIMULATION SCOPE   The extent to which a given simulation "plays" an
                   ARTEP task or subtask, critical element or staff
                   action.

SIMULATION   The characteristics, limitations, processes and feed-
SUITABILITY   back potential associated with a given simulation,
                   which provide an understanding of how simulations work
                   vis-a-vis specific training objectives.

STAFF ACTION   A piece of organized activity by an individual staff
                   section directed at, or contributing to, the fulfill-
                   ment of one or more staff tasks or subtask. All staff
                   actions begin with some kind of triggering event; all
                   actions end with one or more concluding events.

APPENDIX B

SUMMARY OF SIMULATION DESCRIPTIONS

APPENDIX B. SUMMARY OF SIMULATION DESCRIPTIONS

TITLE	TYPE	ECHELON	SCENARIO	PURPOSE	PLAYERS OR PLY/CONTROL	CONTROLLERS	TRAINING TIME	PLAYING TIME
DUNN-KEMP	Battle Simulation (Manual)	U.S. Company Team/Threat Tank Battalion	Choice of Maneuver/European Terrain	Train Company Leaders in: Small unit and maneuver tactics, proper use of terrain, U.S. and threat weapon system employment and lethality, use of supporting fires to include smoke and suppression.	8	1	2 Hours	
PEGASUS	Battle Simulation (Manual)	U.S. Battalion or Brigade/Threat Motorized Rifle Division	(1) Active Defense (2) Offense	To exercise battalion and Brigade Command Groups in the performance of ARTEP tasks associated with the control and coordination of combined arms in a simulated combat environment.	BN: 13-23 BDE: 35-63	BN: 4	8-12 Hours	Varies with Unit and Scenario.
FIRST BATTLE	Battle Simulation (Manual)	U.S. Armored Division/Threat Tank Army	Division Defense Along German Border	Train Division Commanders and Staffs in control and co-ordination of combined arms operations in a simulated environment against a realistic enemy force. Evaluate unit tactical SOPs.	TBD by Unit.	1 Exercise Director	Open - 6 Hours (+) Closed - 8 Hours (+)	X 48 hrs (+) per Scenario
WAR EAGLE	Battle Simulation (Manual)	U.S. Corps/Threat Armies	Independent	To simulate combat operations and train corps and division and command groups as well as key staff agencies.	TBD by Unit	TBD by Unit	10 Hours (+)	48 Hours (+)
BATTLE	Battle Simulation (Computer)	U.S. Battalion Task Force Treat Regiment (+)	Choice of Maneuver Choice of Terrain	Train battalion and subordinate commanders in use of terrain in the active defense U.S. and threat employment.	2 (Minimum)	1 Mi: ... + 1 Console Operator	Players: 2-4 Hours Controllers: 8 Hours	

TITLE	TYPE	ECHELON	SCENARIO	PURPOSE	PLAYERS OR PLY/CONTROL	CONTROLLERS	TRAINING TIME	PLAYING TIME
CATTS	Battle Simulation (Computer)	U.S. Battalion vs Motorized Rifle Regiment	Middle East or European Exercises for Maneuver Battalions/Squadrons	Train maneuver battalion and cavalry squadron command groups to attain and sustain ARTEP standards in a simulated environment vs realistic enemy forces.	7	14	Player/ Controllers Trained for 4 Hours	3 Days/ Active Bn 2 Days/Res. Comp. Bn.
CAMMS	Battle Simulatioin (Computer)	U.S. Battalion or Brigade Threat Regiment or Division.	Any Terrain Infantry, Mechanized, Cavalry, Armor up to Brigade Level, Attack or Defense.	Train battalion and brigade command groups to attain and sustain ARTEP standards in the the control and co-ordination of combined arms operations in a simulated environment vs realistic enemy forces. Evaluates unit tactical SOPs.	BN: 4-12 BDE: 12-36	BN: 6 + Term Op BDE: 11 + 4 Term Op	4-6 Hours	Min: 8 Hours Max: No Limit
ADMIN MOD	Support Module for Use with Battle Sims.	U.S. Battalion or Brigade.	Independent	Enhance training of battalion/brigade S1's and company personnel. Establish interaction between S1 and S4 at battalion/brigade level.	1-9		1-4 Hours	
LOG MOD	Support Module Stands Alone.	U.S. Battalion or Brigade.	Independent	Enhance Training of maneuver battalion S4's, support platoon and company personnel.	2 or More		1-4 Hours	
BLOCK BUSTER	Battle Simulation Future (Manual)	U.S. Company Team vs Reinforced M.R. Battalion with Tank Company.	Company Team Defending from FRG Village as Part of U.S. Battalion Task Force Conducting MOUT.	Train company commander and platoon leaders to plan and conduct combat operations in and around a typical village.	15	2-3	Players 3 Hours Controllers 5 Hours	X 8 Hours

TITLE	TYPE	ECHELON	SCENARIO	PURPOSE	PLAYERS OR PLY/CONTROL	CONTROLLERS	TRAINING TIME	PLAYING TIME
ARTBASS	Battle Simulation Future (Computer)	U.S. Battalion, Motorized Rifle Division.	Any Area for which DMA Digitalized Terrain is Available.	Train maneuver battalion and cavalry squadron command groups to attain and sustain ARTEP standards in the control and coordination of combined arms operations and a simulated environment vs realistic enemy forces.	7	10	Player/Controllers Trained X 5 Hours	3 Days/Active Bn 2 Days/Res. Comp. Bn.
CAMMS II	Battle Simulation Future (Computer)	U.S. Battalion, Brigade, Division/ Threat Regiment Division, or Army	Choice of Maneuver/ Choice of Terrain	Train battalion, brigade, or division commanders/staff in control and coordination of combined arms operations in a simulated environment vs realistic enemy forces evaluates unit tactical SOPs.	TBD during Development	TBD during Development	TBD during Development	Min: 8 Hours Max: No Limit

APPENDIX C
DIVISION-LEVEL CRITICAL ELEMENTS

APPENDIX C
DIVISION-LEVEL CRITICAL ELEMENTS

Task 1
Develop Plan Based on Mission

I.a. PREPARE PLANS AND ORDERS

I.a. 001   Analyze Mission Statement Received (CMDR)

I.a. 002   Determine Tasks and Objectives

101 To 701	Staff Performs Preliminary Analyses of Situation	MISSION ANALYSIS
003	Commander Issues Mission Restatement and Guidance	
202	G2 - Analysis of Area of Operations (Terrain and Weather)	Observation & Fire Concealment
203	- Analysis of Enemy Situation	& Cover Obstracles
204	- Evaluation of Enemy Capabilities and Vulnerabilities	Key Terrain Avenues of Approach
205	- Identification of Enemy Alternative Courses of Action	
206	- Compile All Intelligence Needed By G3	
2u7	- Coordinate with SWO on weather conditions	
302	G3 - Analysis of Relative Combat Power	
3u3	- Analysis of Own Situation	
304	- Analysis of Own Capabilities and Vulnerabilities	
305	- Analysis of Own Alternative Courses of Action	
306	- Analysis of Enemy Courses of Action	

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1: Develop Plan Based on Mission

307   - Identification of Alternatives

308   - Evaluation of Alternatives Vis-A-Vis
           G1/G4/FSE/ADP Input

309   - Integration of Support Plans into
           Operation's Plans

102   G1 - Analysis of Own Personnel Situtation

103   - Define Personel Requirements for Each
           Alternative Operation

104   - Determine Feasibility of Each Alternative
           Vis-A-Vis Personnel

105   - Prepares Personnel Relocation Plans to
           Support Chosen Operations Plan

106   - Brings Unit Strengths Up to Standard Levels

402   G4 - Analysis of Own Logistics Situation

         - (See Subtask I.e.)

       ADA- (See Subtask I.k.)

       FS COORD - (see Subtask I.c.)

I.b. ORGANIZE AND EQUIPMENT UNITS FOR COMBAT

       G1 - (See Subtask I.a)

I.b. 314   G3 - Compiles Troop List

      315   - Determines Numbers and Types of Units Needed
                 for Operation

             G4 - (See Subtask I.e.)

I.c. PLAN EMPLOYMENT OF FIRE SUPPORT

I.c. 212   G2 - Prepares List of Potential Targets

      213   - Develops Detailed Target Information

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DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1: Develop Plan Based on Mission

214   - Compiles Fire Support Information for FSECOORD

I.c. 605   FSCOORD - Determines Fire Support Requirements

606   - Determines Target List

607   - Determines Feasibility of Plan Vis-A-Vis Artillery Capabilities

(608)   - (Recommends FA Target Acquisition Plan)

(609)   - (Recommends Radar Emplacement)

(610)   - (Recommends Direct Fire/Counterbattery Ratio)

(611)   - (Recommends Ammunition Supply Rate)

(612)   - (Recommends Allocation and Assignment of Nuclear FA Weapons)

(613)   - (Recommends Allocation and Assignment of Chemical FA Weapons)

614   - Determines Emplacement of GS Units

319   G3 - Integrates Fire Support Plan into Operations Plan

I.d. PLAN NBC CONTINGENCIES

I.d. 110   G1 - Estimates Casualties Depending on Scenario

111   - Estimates Fallout Effects on Support Personnel

112   - Determines Replacement Requirements

113   - Initiate Planning to Minimize Effects

114   - Establishes Troop Safety Criteria

(219) G2 - (Recommends Targets for Special Weapons

I.d. 220   G2 - Estimates Enemy Reaction to NBC Use

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1: Develop Plan Based on Mission

221		- Estimates Weapon Effects or. Area uf Operations
222		- Estimates Weapon Effects oii Enemy
223		- Estimates Weapon Effects on Intelligence Operations
224		- Revises Data Collection Plan as Necessary
324	G3	- Incorporates Appraisals into Operations Plan
325		- Prepares Alternative Actions
326		- Plans Employment of Nuclear and Chemical Weapons
327		- Prepares Artillery Support
328		- Compiles Target Analysis and Damage Assessments

I.e. INTEGRATE COMBAT SERVICE SUPPORT

I.e. 111	G1	- Provides Unit Strengths
120		- Provides Loss Estimates
230	G2	- Determines Enemy Capability to Disrupt Logistics
231		- Analysis of Area cf Operations of Logistics Activities
333	G3	- Recommends Allocations and Priorities for Equipment and Supplies
334		- Recommends Prescribed Loads for Equipment
335		- Provides Required Supply Rates for Subordinate Commands
336		- Provides Anticipated Attachments, Assignments, etc., for Logistics Planning
337		- Provide Nuclear Weapon Security Troops
410	G4	- Determines Food Needs for Support of Plan
411		- Determines Maintenance Needs for Support of Plan
412		- Determines Ammunition Needs for Support of Plan

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1: Develop Plan Based on Mission

413   - Determine POL Requirements

414   - Determine Consumption Rates of Above Supplies

415   - Examines Replacement Factors for Future Needs

416   - Prepares Procurement Plan

417   - Prepares Storage Plan

418   - Prepares Distribution Plan

419   - Maintain Status or Supplies

I.f.   PLAN EW OPERATIONS

I.f.   235   G2 - Prepares Deception Plan

236   - Determines Intelligence Requirements

237   - Determines EW Target Priorities

238   - Plans Intelligence Collection Resources to Support EW

34   G3 - Integrates EW Plan into Operations Plan

I.g.   DEVELOP COMMUNICATIONS PLAN

I.g.   242   G2 - Estimates Enemy Capability to Interfere with Signal Commo

243   - Supervises Counter-Intelligence Aspects

244   - Submits Signal Commo Requirements to C-E

345   G3 - Establishes Tactical Support Commo Priorities

346   - Ensures Compatability of Priorities with Plan

I.h.   PLAN OBSTACLE EMPLOYMENT

I.h.   250   G2 - Analysis of Area of Operations

251   - Estimates Enemy Axes/Routes of Advance

350   G3 - Designates Location of Obstacles

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1: Develop Plan Based on Mission

351		- Determines Zones of Priority
424	G4	- Ensures Availability of Obstacle Material

I.i. PLAN RIVER CROSSINGS

I.i 255	G2	- Analysis of Area of Operations
355		- Develops Schedule of Raft US Bridge Construction
356		- Determines River Crossing Sites
357		- Develops Plan for Securing Sites
358		- Develops Plan for Protecting Sites
359		- Develops Conceptment and Deception Techniques
360		- Develops Traffic Regulation and Control Plann
361		- Coordinates Transfer of Responsibility to Corps for Control and Maintenance of Site

I.j. ESTABLISH AIR DEFENSE PRIORITIES

I.j. 259	G2	- Determines Enemy Air Capabilities
260		- Estimates Enemy Intentions
365	G3	- Determines Critical AD Areas
366		- Reviews ADA Fire Support Plan from DAME
367		- Coordinates Use of Air Space
368		- Establishes AD Priorities
705	ADA	- Determines Requirements for AD Units
706		- Recommends Allocations of AD Units to Subordinate Units
707		- Recommends ADA Unit Tactical Missions
708		- Recommends AD Priorities
709		- Coordinates with G2 in Establishing AD Intelligence System

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 1:   Develop Plan Based on Mission

710   - Plans and Coordinates the Use of Airspace with Aviation
             Assets

711   - Analyzes Enemy AD Capabilities

712   - Recommends Measures to Counter or Evade Enemy AD

713   - Monitors Readiness Status of ADA Units

714   - Advises on ADA EW Operations

715   - Plans EW Operations within AD

I.k.   INTEGRATE AIR FORCE AND ARMY AVIATION ASSETS INTO PLAN

Task 2:   Initiate Intelligence Preparation of the Battlefield

II.a. PREPARE ANALYSIS OF AREA OF OPERATIONS

II.a. 201 G2 - Analysis Terrain and Terrain Effects on Opposing Forces

   202   - Receive from SWO Necessary Weather Information

   203   - Updates Intelligence as New Information is Received

           (Staff uses above information for evaluation of the
           effect on activities with which they are concerned.)

II.b. FORMULATE DIVISION INTELLIGENCE COLLECTION PLAN

II.b. 208 G2 - Identify Division Intelligence Requirements (FM 30-5,
                pp. 3-6,7)

   (209)   - (Recommends EEI to Commander Derived from above Requirements)

   210   - Determines Allocations of Intelligence Resources

   211   - Determines Priorities of Intelligence Resources

   212   - Coordinates All-Source Intelligence Collection

   213   - Integrates Intelligence Collection from Other Sources (CIA,
               DIA, Organic)

   214   - Translate EEI into Specific Missions for Army SIGINT Units

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DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 2: Initiate Intelligence Preparation of the Battlefield

(104)   G1 - (Recommends to G2 Personnel-Related EEI)

(305)   G3 - (Recommends to G2 EEI Concerning Enemy Capabilities and
                 Vulnerabilities)

(403)   G4 - (Recommends to G2 Logistics-Related EEI)

II.c. PREPARE RECONNAISSANCE, SURVEILLANCE AND TARGET ACQUISITION PLANS

II.c. 220   G2 - Plans Target Acquisition Activities

     221   - Coordinates All Surveillance Activities

     223   - PLANS RECONNAISSANCE MISSIONS

     224   - Identifies Critical Areas for above Missions

     225   - Emplaces Sensors to Watch Entire Battlefield

     308   G3 - Designates Units to Conduct Surveillance

     309   - Furnishes Location of Own Forces

     310   - Furnishes Information on Operations Plan

     311   - Designates Required Target Characteristics Information

     312   - Evaluates Potential Targets Developed by G2

     313   - Makes General Target Analysis

     600   FSCOORD - Coordinates Suppression of Artillery Fires in
                        Area of Reconn

     606   - Requests Information on Physical Characteristics of
                        Targets

     607   - Informs G2 of Combat Surveillance Information Received
                        from Arty Sources

     608   - Makes Deatiled Target Analysis

     609   - Furnishes Target Information

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 3: Control and Coordinate Combat Operations

III.a.   IMPLEMENT PLANS AND ORDERS

III.a. 101   G1 - Updates File of Personnel Losses

102   - Updates File of Personnel Additions

(103)   - (Recommends Unit Deployment WRT Personnel Strength)

104   - Supplies G4 with Personnel Information for CSS Analysis

105   - Coordinates Distribution of Personnel Throughout Division

201   G2 - Monitors and Supervises Collection of Information

202   - Monitors and Supervises Processing of Information

203   - Monitors and Supervises Dissemination of Information

204   - Provides G3 with Current Enemy Situation

205   - Provides G3 with Current Enemy Capabilities and
                 Vulnerabilities

206   - Updates Intelligence Priorities

207   - Updates Intelligence Resource Allocations

301   G3 - Maintains Current Operations Appraisal

302   - Maintains Current Situation

303   - Maintains Current Status of Resources

304   - Monitors Execution of Orders

305   - Monitors Execution of Supporting Plans

306   - Monitors Fire Support Activities

307   - Revises Plans According to Tactical Situation

308   - Maintains Updated files on Personnel (From G1)

309   - Maintains Updated Files on Intelligence Activities
                 (From G2)

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 3: Control and Coordinate Combat Operations

310   - Maintains Updated Files on CSS Functions (From G4)

311   - Regulates Subordinate Units to Follow Plan

401   G4 - Maintains Current Status of Food Supplies

402   - Maintains Current Status of POL Supplies

403   - Maintains Current Status of Ammunition Supplies

404   - Maintains Maintenance Situation

405   - Revises Projected CSS Requirements Based on above
             Information

406   - Coordinates CSS Activities with DISCOM

407   - Monitors Logistics Operations for Compatibility with OPLAN

601   FSCOORD - Monitors Fire Support Activities

602   - Revises Counterbattery/Direct Fire Proportions as
                  Needed

603   - Revises/Updates Target List

604   - Monitors Relocation of Radars

605   - Monitors Ammunition Supply

606   - Monitors Massing or Artillery Fire

701   ADA - Revises AD Critical Areas

702   - Revises Friendly Target Priorities

III.b. DIRECT COMBAT OPERATIONS

III.b.   G1

             G2

             G3   Same As III.a.

             G4

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 3: Control and Coordinate Combat Operations

FSCOORD

ADA

    - Ensures Adequate Communications

    - Ensures Proper Organization for 24 Hour Operation

III.c. Through III.g. (Same as III.b.)

Task 4: See the Battlefield

IV.a. COLLECT INTELLIGENCE INFORMATION

IV.a.   G2 - Same as II.b., II.c., and III.a

    201   - Prepares Updates for G3

    301   G3 - Identifies and Submits EEI

    G1
           (Submit Related EEI)
    G4

IV.b. ANALYZE INFORMATION AND EVALUATE ENEMY CAPABILITIES

IV.b. 205   G2 - Record Information

    206   - Determine Reliability of Information

    207   - Determine Relevance of Information

    208   - Evaluate Information

    209   - Interpret Information to Produce Intelligence

    210   - Evaluate Enemy Situation

    211   - Evaluate Enemy Capabilities and Vulnerabilities

    212   - Estimate Enemy Intentions

    213   - Disseminates Intelligence to G3

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 5: React to Enemy NBC Operations

IV.c. DETERMINE MOST PROBABLE ENEMY COURSE OF ACTION

IV.c. G2 - Integration of above Analyses and Evaluations

IV.d. DISSEMINATE INTELLIGENCE

Task 5: React to Enemy NBC Operations

V. 101 G1 - Monitors and Supervises Evacuation and Hospitalization of NBC Casualties

102 - Updates Personnel Situation Based on Effects of NBC Attack

201 G2 - Coordinates Execution of Fallout Protection Plans

202 - Monitors Survey Operations

203 - Collects NBC Reports

204 - Disseminates NBC Reports

205 - Evaluates Effect of Fallout on Area of Operations

206 - Evaluates Effect of Fallout on Enemy and Friendly Operations

301 G3 - Reviews Reports on NBC-Affected Units and Areas

302 - Updates Operations Appraisal Based on NBC Effects

303 - Recommends Alternate Course of Action

304 - Reorients Units to Accomplish Mission

401 G4 - Determines Status of Supplies and Equipment

402 - Updates Logistics Appraisal

403 - Prepares Reallocation Plans

404 - Develops Area Damage Control Plans

DIVISION-LEVEL CRITICAL ELEMENTS (Cont'd)

Task 7: Provide for CSS to the Division

Subtask VII.a. - VII.d.

           G1 - Ensures Proper Medical Support is Provided

                - Ensures Adequate Personnel Replacement

                - Ensures Adequate Subsistence is Provided to Troops

                - Coordinates above Needs with Other Staff Sections

           G3 - Provides Changes to Task Organization, Troop Displacement
                 and Tactical Plan to G4

           G4 - Ensures CSS Assets Oriented to Systems and Equipment are
                 Provided to Army, Fuel and Fix the Systems

                - Coordinates with Other Staff Sections and DISCOM

APPENDIX D

STANDARDS AND PERFORMANCE DEFICIENCIES

STANDARDS AND PERFORMANCE DEFICIENCIES

	QUOTED FROM ARTEP		PROPOSED	
SUBTASK	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES
1A.	1) Timely dissemination of OPLAN/OPORD. 2) Timely dissemination of warning orders. 3) Accomplishment of road movement planning. 4) Achievement of required combat ratios (time & place).	1) OPLAN/OPORDER received too late by sub. units. 2) Warning orders not received within specified times. 3) Road movement planning not adequately accom. 4) Required combat ratios not achieved.	1) Plan developed and disseminated to provide sub. units sufficient time to prepare and execute own individual missions. 2) Appropriate warning orders preceding plan should be issued to sub. units. 3) Plan to contain road movement schedules which provide for orderly movement of troops/equipment with minimal delays. 4) Plan to provide projected combat ratios at critical times and places. Ratios to meet required norms. 5) Plan clearly integrates all supporting functions (subsequent Task 1 subtasks). 6) Plan is clear and unambiguous, and properly formatted.	1) One or more sub. units receives plans/orders too late to effectively accomplish their missions (1 and 2). 2) Plan does not contain required road movement schedules, or schedules exhibit discernible traffic bottle-necks. 3) Plan improperly formatted.
1B	1) Replacements to subordinate units are prioritized. 2) Division is task-organized to achieve required combat ratios.	1) Replacements not assigned in a timely or systematic manner. 2) Required combat ratios are not achieved.	1) Division is to be task-organized to achieve required combat ratios. 2) Projected combat ratios to account for current status of subordinate units. 3) Replacements are scheduled according to estimated losses and importance of units to mission accomplishment.	1) Projected combat ratios (current or future) are incorrectly calculated (1 & 2). 2) Plan does not specify adequate replacement schedules (3).
1C	1) Counterfire programs are initiated to include CAS and NGP. 2) Fire support planned to provide desired combat ratios.	1) No counterfire programs initiated. 2) Required combat ratios not achieved.	1) Fire support planning to incorporate all available means (organic & supporting), to include CAS and NGF. 2) Plan to reflect initial ratio of supporting fires to counterfire. 3) Plan to reflect proper emplacement of fire support assets (general and direct).	1) Improper emplacement of fire support assets (3). 2) Initial fire support ratios are not consistent with projected combat ratios (2).

SUBTASK	QUOTED FROM ARTEP		PROPOSED	
	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES
1D	1) Plan most opportune time and place for NUC and chem weapons. - Ensures maximum destruction of enemy forces. - Ensures minimum destruction of friendly force/ civilians.	1) NUC and chem weapons "wasted." 2) Friendly and civilian casualties too high. 3) Plan for use of weapons not adequately developed prior to use.	1) Determine most opportune time and place for nuclear and chemical weapons to inflict maximum damage on enemy forces while holding friendly & civilian casualties to a minimum.	1) Troop safety criteria incorrectly applied.
1E	1) Plans developed for all approved contingencies and operations. 2) Provide CSS at right time and place, and in right amounts.	1) Plans lacking for some contingencies or operations. 2) Inadequate CSS for some units. 3) Units receive CSS too late for mission accom.	1) CSS plan consistent with approved scheme of maneuver.	1) CSS plan exhibits discernible inconsistencies.
1F	1) Plan for correct positioning of ESM assets. 2) Plan for ECCM.	1) Ineffective target acquisition. 2) Consistently unfavorable combat ratios. 3) Friendly forces rendered ineffective by enemy ECM. 4) Enemy successfully employs ESM.	1) Plan for proper emplacement and utilization of ESM assets (proper = consistent with EEI). 2) Plan for ECCM. 3) Plan for ECM in a manner consistent with approved scheme of maneuver.	1) ESM plan exhibits discernible inconsistencies with EEI requirements. 2) ECCM not adequately planned for in accordance with enemy capabilities.
1G	1) Identify and plan communications required for mission. 2) COMSEC provided for. 3) Alternate communications established.	1) Commo. plan not adequately developed. 2) COMSEC inadequate. 3) Periodic loss of contact with other units.		1) Obstacle plan not consistent with scheme of maneuver.
1H	1) Zones of priority are established for obstacle emplacement. 2) Obstacle plan does not affect brigade flexibility WRT obstacle emplacement. 3) Obstacle plan: - Facilitates friendly forces movement. - Provides adequate protection by impeding enemy. - Is coordinated with system capabilities and operations. - Does not impede friendly movement.	3) - Obstacles impede friendly forces. - Do not impede enemy as desired. 2) Obstacle plan does not allow brigade flexibility.	1) Plan to establish zones of priority for obstacle emplacement. 2) Obstacle plan consistent with scheme of maneuver. - Does not constrict BDE flexibility. - Provides maximum impedance to enemy forces. - Does not impede friendly forces.	1) Priorities not established or priorities incorrectly established. 2) AD plan not coordinated with DAME.

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SUBTASK	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES
1J	1) AD priorities properly determined. 2) AD assets assigned to provide maximum protection of friendly units in accordance with priorities. 3) AD plan developed in timely manner.	1) Most critical targets not assigned adequate AD (standard (1) or (2)). 3) AD assets not emplaced in time.	1) AD priorities established consistent with overall plan. 2) AD assets placed to provide maximum protection in accordance with established priorities. 3) AD plan incorporates air space management coordination.	
1K	1) AF assets fully utilized in support of division objectives. 2) Army aviation assets fully utilized for mission. 3) Army and AF asset utilization coordinated such that each performs missions best suited for capabilities. 4) Deficiencies are compensated.	1) Under utilization of air assets (1 and 2). 2) Army and AF assets perform same missions (3). 3) Inadequate support missions (1, 2, and 4).	1) Available Army aviation assets to be fully utilized in support of mission. 2) AF assets fully utilized in support of division objectives. 3) Use of assets coordinated so that each performs missions best suited to its capabilities.	1) Plan shows that aviation assets are not fully utilized (1 and 2). 2) Plan shows that Army and AF aviation assets are not coordinated.
2A	1) Accurate analysis of area of operations.	1) Effectiveness of friendly and enemy forces do not compare with calculated effectiveness.	1) Analysis of area of operations to be complete and continuously updated.	1) Plan does not reflect in sufficient detail terrain effects on enemy and friendly capabilities.
2B	1) EEI are identified and ranked. 2) Intel collection plan satisfies EEI requirements.	1) Intelligence information not adequate for accomplishment of	1) EEI identified and ranked. 2) Specific intel. collection missions derived from and in support of approved EEI. 3) Allocation of intelligence collection assets consistent with (2).	1) Identified EEI or ranking of EEI not consistent with division obj. (1). 2) Intel. collection missions do not support EEI (2).
2C	1) Plan complements and is coordinated with 2B. 2) Detection of enemy activity and significant targets prior to damage to division by them.	1) Intelligence information not adequate for accomplishment of mission. 2) Damage to division through enemy activity and targets not detected in time.	1) Intelligence collection plan (2B) to specify reconnaissance, surveillance and target acquisition requirements to provide continuous, all-weather surveillance of battlefield. 2) Plan provides for detection of enemy activities and significant target to prevent surprise damage to the division.	1) Intelligence collection plan reflects sporadic interruptions in continuous monitoring of the battlefield (1). 2) Heavy damage inflicted on division by undetected enemy activities or weapon systems (2).
2D	1) Intelligence assets allocated to provide adequate, accurate and timely intelligence support to commanders. 2) Ensure continued intelligence collection, processing and dissemination in event of neutralization of one or more CP's.	1) Intelligence information not adequate for accomplishment of mission.	1) See 2B - (3).	

SUBTASK	QUOTED FROM ARTEP — STANDARDS	QUOTED FROM ARTEP — POTENTIAL PERFORMANCE DEFICIENCIES	PROPOSED — STANDARDS	PROPOSED — POTENTIAL PERFORMANCE DEFICIENCIES
3A	1) Exploitation of enemy vulnerabilities. 2) Maximize friendly capabilities. 3) Minimize friendly losses. 4) Revisions to plans and orders must reflect changes in tactical situation. 5) Orders are timely.	1) Mission cannot be accomplished. 2) Friendly forces suffer unaccertable losses. 3) Orders not timely.	1) All FRAG orders associated with current OPLAN must be timely. 2) CG/staff must recognize when tactical situation dictates revisions to plans and orders.	1) FRAG orders not timely (1). 2) Current operations do not reflect such recognition (2).
3B	1) Communications always maintained with subordinate units. 2) Staff organized for 24 hour operations. 3) All division CP's capable of assuming direction of the of the battle. 4) Required combat ratios are achieved at critical times and	1) Communications sporadically lost with units. 2) CP does not operate during some intervals. 3) Required combat ratios not achieved. 4) Direction of battle is not transferred after neutralization of division CP.	1) Adequate commo. to be maintained with sub. units. 2) Displacement of division CP's coordinated to provide continuous direction of combat operations. 3) Fundamental goal in directing combat operations stated under III D.	1) Commo. with sub. units disrupted due to inadequate staff planning (1). 2) Direction of combat operations discontinuous due to lack of coordinated CP displacement.
3C	1) Successful accomplishment of subordinate unit missions.	1) Subordinate unit missions not accomplished.	(Subsumed under 3B.)	
3D	1) Current friendly tactical situation analysis should be 100 percent accurate. 2) Analysis of enemy situation as accurate as available information permits.	1) Analysis of friendly situation 100 percent accurate. 2) Analysis of enemy situation is faulty.	1) Displayed and non-displayed (filed) information on status of friendly forces to be accurate and current. 2) Displayed and non-displayed information on enemy situation and capabilities should be as current and accurate as possible.	1) Displayed information exhibits too long a time lag or inaccuracies (1 and 2). 2) Non-displayed data exhibits too long a time lag or inaccuracies (1 and 2).
3E	1) Required combat ratios are achieved.	1) Required combat ratios are not achieved.	1) Required combat ratios to be achieved and sustained at critical times and places.	1) Required ratios not achieved or sustained at critical times and places.
3G	1) Airspace above division available for simultaneous use without restrictions to or losses of friendly airspace users.	1) Airspace management not coordinated for simulataneous use.		
3H	1) Detection and location of enemy EM emitters for timely neutralization (destruction, disruption, deception). 2) Exploitation of enemy vulnerabilities.	1) Enemy ESM effective against friendly forces. 2) Friendly units damaged by surprise engagements.	1) Re-allocation of ESM assets as tactical situation dictates (to prevent surprise damage of commo. disruptions to division). 2) For targets to be destroyed, routing of ESM intercept information	1) Failure to reallocate ESM assets resorts in one or more of the following: (1) - Surprise damage sustained by division - Commo. disrupted

SUBTASK	QUOTED FROM ARTEP STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES	PROPOSED STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES
	3) Protect friendly units from surprise.		to use for target engagement. 3) Application of ECCM against enemy REC techniques to provide continous and effective commo. with other units.	- Sporadic shortages of current and necessary target info/ intelligence. 2) ESM intercept info routed to FSE too late for target engagement (2). 3) Sporadic disruptions of commo. through effective use of REC technique (3).
4A	1) Collection of all-source intelligence to provide 70 percent accurate assessment of enemy situation. 2) 80 percent of commander's critical intelligence needs are answered.	1) Inadequate intelligence acquired for accomplishment of mission.	1) Supervision of intelligence collection resources to ensure that critical combat information and confirmed intelligence is obtained from all sources, particularly prior to decisive combat. 2) Above collected info must: - Satisfy commander's critical intel needs - Provide accurate and up-to-date assessment of enemy situation.	1) Unacceptable time lag in displays and non-displayed info re enemy situation. 2) Collected info/intel does not: - Satisfy commander's critical intel needs, - Reflect changes to critical intel needs, or - Provide for accurate assessment of enemy situation.
4B	1) Enemy capabilities are evaluated to allow commander to react to any enemy capability. 2) Required combat ratios are achieved. 3) Friendly units to suffer minimal losses.	1) Division cannot react to a particular enemy course of action. 2) Required combat ratios are not achieved. 3) Friendly units suffer unacceptable losses. 4) Enemy counter-attack more effective than was calculated.	1) Enemy capabilities evaluated to ensure that required combat ratios are achieved. 2) Enemy capabilities evaluated to produce all alternative enemy courses of action.	1) Required combat ratios not achieved. 2) Division not able to react to an enemy course of action.
4C	1) Accurate intelligence disseminated to higher, adjacent and subordinate units which need it, in a timely manner.	1) Those units in need of division intelligence do not get it in time to accomplish respective missions.	(Same as quoted)	1) Sub/adj units and higher HQ which need intelligence don't receive it. 2) Sub/adj units and higher HQ which don't need intelligence receive it. 3) Intelligence dissemination not timely. 4) Disseminated intelligence not presented in clear and unambigous terms.
5A-5B	1) Division is able to continue combat and support operations to accomplish mission. 2) Burst data, damage, assessment and emergency decontamination information to be collected, processed and reported as required.	1) Disruption through NBC attack causes failure to accomplish mission.	(Same as quoted)	1) Division crippled by nuclear/ chemical attacks.

	QUOTED FROM ARTEP		PROPOSED	
SUBTASK	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES	STANDARDS	POTENTIAL PERFORMANCE DEFICIENCIES
7A-7B	1) Ammunition and fuel is distributed in timely manner in accordance with commander's priorities.	1) Units receive ammunition or fuel too late to accomplish missions. 2) Most critical units fail to receive ammunition or fuel.	(Same as quoted)	1) Distribution not consistent with commander's priorities. 2) Ammo and fuel distributions not timely.
7C	1) systems essential to mission accomplishment are repaired and returned to combat in sufficient numbers and in time to maintain combat ratios.	1) Units exhibit shortage of essential equipment. 2) Required combat ratios are not maintained.	(Same as quoted)	(Same as quoted)
7D	1) Health and medical support, subsistence and personnel replacements are prioritized in order to sustain combat effectiveness and ratios.	1) Required combat ratios are not maintained.	(Same as quoted)	(Same as quoted)

APPENDIX E

INITIAL ASSESSMENT OF SIMULATION SUITABILITY

This appendix tabulates the results of the initial assessment of simulation suitability with respect to simulation scope and potential indicators of staff performance deficiencies. The list of critical elements used in this table is a selected subset of the total set of critical elements derived for division and provided in Appendix C. Two factors were used in this selection. First, this subset of critical elements is a representative sample of the various command control functions and activities associated with the ARTEP task and subtask formulations. Second, the underlying concepts of these critical elements are common to division, brigade and battalion; the results given in this appendix apply to all simulations at these echelons.

The assessment of simulation scope simply provides an answer to the question: Do the simulations of interest "play" each critical element. As seen in the second column of the table, the answer is "Yes" for all simulations at division, brigade and battalion levels vis-a-vis all of the selected critical elements. Thus, the initial assessment of simulation scope shows that the simulations do accommodate the ARTEP tasks and subtasks. The complete assessment of simulation scope must await the development of the finalized list of critical elements for each echelon.

The second portion of the table provides an initial list of indicators of staff performance deficiencies. As noted in the text, two types of indicators have been identified: outcome (or board) and staff. The table provides one example of each type of indicator vis-a-vis each of the critical elements, where applicable. The class of performance deficiency associated with each critical element/indicator is also provided, taken from Table 3-14.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
I001	Analysis of Mission Statement	Yes	--	Maneuver does not support higher Hq mission.	OPORD**
I2C2	G2: Analysis of Area of Operations	Yes	IV	Unexpected problem in movement.	OPORD requires maneuver over poor terrain.
I203	G2: Analysis of Enemy Situation	Yes	II	Unexpected enemy strength.	OPORD
I205	G2: Analysis of Enemy Alternative Courses of Action	Yes	IV	OPFOR attack against an economy of force area.	OPORD
I302	G3: Analysis of Relative Combat Power	Yes	VII	Unable to accomplish assigned mission w/ resources.	OPORD
I305	G3: Analysis of Own Alternative Courses of Action	Yes	VII		OPORD
I307	G3: Identification of Alternatives	Yes	X		OPORD

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* Potential performance deficiency (see Table 3-14, page 3-51).

** The "OPORD" entry indicates that the Operations Order (or Plan) should be evaluated to determine the degree to which the Critical Element was addressed. In some cases this may only be done by inference.

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TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
I309	G3: Integration of Support Plans into Operations Plans	Yes	VI	Unit low on ammunition is key attack element.	OPORD
I310	G3: Issues Warning Order	Yes	V	Units do not have time to plan.	No warning order.
I311	G3: Issues OPORD	Yes	X		Incomplete OPORD.
I102	G1: Analysis of Own Personnel Situation	Yes	II	Unit very understrength of K key attack element; attack fails.	No verification current personnel situation.
I105	G1: Prepares Personnel Relocation Plans to Support Chosen Operations Plan	Yes	VII	"	OPORD attachments/ detachments.
I402	G4: Analysis of Own Logistics Situation	Yes	II	Units run out of fuel.	No update of POL status.
I314	G3: Compiles Troop List	Yes	IV	Units confused as to assignment.	Elements missing in OPORD.
I212	G2: Prepares List of Potential Threats	Yes	IV	Attack fails.	Major enemy element does not appear in OPORD.
I606	FSCOORD Determines Target List	Yes	VII	Fire support ineffective.	Targets are not in the location plotted.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
I614	FSCOORD Determines Emplacement of GS Units	Yes	VII	GS units out of range.	OPORD mission and coordinating instructions.
I114	G1: Establish Troop Safety Criteria	Yes	III		Personnel with large exposure to radiation used in key area.
I219	G2: Recommends Target for Special Weapons	Yes	V	Nuclear fires ineffective.	Latest information on enemy positions is not used during fire.
I326	G3: Plans Employment of Nuclear and Chemical Fires	Yes	X	Targets not selected when employment directed.	OPORD
I120	G1: Provides Loss Estimates	Yes	VII		
I2 C	G2: Determines Enemy Capability to Disrupt Logistics	Yes	I	Supply points left unprotected.	No contingency in OPORD for protecting supply points.
I333	G3: Recommends Allocations and Priorities for Equipment and Supplies		VI		OPORD

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
I335	G3: Provides Required Supply Rates for Subordinate Commands	Yes	X	Units out of ammunition.	ASR not compatible.
I412	G4: Determines Ammunition Needs for Support of Plans	Yes	VII	Units out of ammunition.	ASR not compatible with on hand quantities.
I413	G4: Determines POL Requirements	Yes	IV	Units out of fuel.	No reports indicating fuel status are required.
I419	G4: Maintains Status of Supplies	Yes	III	Shortages of critical end items develop.	Low material situations do not prompt command interest.
I235	G2: Prepares Deception Plan	Yes	VIII		No plan.
I340	G3: Integrates EW Plan into Operations Plan	Yes	VII	"Radio silence" causes unforeseen operational problems.	OPORD
I242	G2: Estimates Enemy Capability to Interfere with Signal Communications	Yes	IX		None
I345	G3: Establishes Tactical Support Priorities	Yes	VI		OPORD

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
I350	G3: Designates Location of Obstacles	Yes	X	Defense fails.	OPORD obstacle plan.
I424	G4: Ensures Availability of Obstacle Material	Yes	X	Planned obstacles are not built.	OPORD combat service support.
I365	G3: Determines Critical AD Areas	Yes	VI	CP not protected.	OPORD attachments and detachments.
I368	G3: Establishes AD Priorities	Yes	VI	AD poorly allocated.	OPORD
I706	ADE Recommends Allocations of AD Units to Subordinate Units	Yes	VI	Attacking units do not receive additional AD assets.	OPORD attachments and detachments.
I708	ADE Recommends AD Priorities	Yes	X		
I713	ADE Monitors Readiness Status of AD Units	Yes	II	AD unit is combat ineffective in critical AD area and receives no replacements.	
II208	G2: Identifies Division Intelligence Requirements	Yes	X		OPORD
II210	G2: Determines Allocation of Intelligence Resources	Yes	VI	Brigade has a disproportionate amount of intelligence assets based on mission.	Communications from G2.

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TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
II211	G2: Determines Priorities of Intelligence Resources	Yes	X	Critical area receives fewest resources.	OPORD
II224	G2: Identifies Critical Areas for Reconnaissance Surveillance and Target Acquisition Plans	Yes	X	Critical area receives poor coverage.	OPORD
II308	G3: Designates Units Conduct Surveillance	Yes	VI	None	OPORD Incomplete
II605	FSCOORD Coordinates Suppression of Artillery Fires in Area of Reconnaissance	Yes	VII	Recon aircraft hit by friendly artillery.	OPORD
II607	FSCOORD Informs G2 of Combat Surveillance Information Received from Arty Sources	Yes	VII	Enemy achieves surprise.	Communication from G2 about status of enemy arty to front.
III101	G1: Updates file of Personnel losses	Yes	II	Board "3" must call G3 about critical personnel shortage.	Message is received detaching critically short elements.
III102	G1: Updates File of Personnel Additions	Yes	II	A unit receives too many of one MOS.	Request received which attempts to allocate area.* personnel already assigned.

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* Item III102 has no counterpart in PEGASUS for battalion or brigade because there is no replacement company at lower echelons.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
III103	G1: Recommends Unit Deployment	Yes	VII	Depleted Brigade remains in key area.	Depleted Brigade not assigned to reserve when possible.
III104	G1: Supplies G4 with Personnel Information for CSS Analysis	Yes	VIII		None
III105	G1: Coordinates Distribution of Personnel throughout Division	Yes	VII	Noncritical unit in scheme of maneuver is over-strength.	Receiving more replacements than are necessary.
III201	G2: Monitors and Supervises Collection of Information	Yes	II	Surprise achieved by OPFOR.	G2 does not reallocate collection resources.
III202	G2: Monitors and Supervises Processing of Information	Yes	V		When an intelligence synopsis is requested none is available.
III203	G2: Monitors and Supervises Dissemination of Information	Yes	VIII	Board "2" has no picture of units behind FEBA.	No traffic to or from G2.
III204	G2: Provides G3 with Current Enemy Situation	Yes	VII	Reserves are not positioned in location to effect mission.	Calls from G3 for independent estimate of the situation.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
III205	G2: Provides G3 with Current Enemy Capabilities and Vulnerabilities	Yes	V	Reserves are not positioned in location to effect mission.	Calls from G3 for independent estimate of the situation.
III206	G2: Updates Intelligence Priorities	Yes	VIII		No follow-up when new type enemy unit encountered.
III207	G2: Updates Intelligence Resource Allocations.	Yes	VI	Frequency of SLR allocation to Bde board does not change where OPFOR main attack occurs.	No reallocation of radar resource occurs during battle.
III301	G3: Maintains Current Operations Appraisal.	Yes	VI	Force ratio radically changes in a few hours.	When requested G3 cannot provide a clear picture of the battle.
III302	G3: Maintains Current Situation	Yes	II	Force ratio radically changes.	Requests for adjacent unit positions are not accurate.
III303	G3: Maintains Current Status of Resources	Yes	VII	Uneven distribution of resources	Mission changes made without consideration of unit status.
III304	G3: Monitors Execution of Orders	Yes	II	Brigades on adjacent boards are at different phase lines.	Unit told to move to a place already occupied.

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TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
III305	G3: Monitors Execution of Supporting Plans	Yes	X	Artillery is not pre-planned on emplaced obstacles.	DIVARTY is not queried.
III306	G3: Monitors Fire Support Activities	Yes	VIII	Artillery is not massed in area of increased vulnerability in the Division area of operations.	Assignment of GS&GSR missions are not according to situation.
III307	G3: Revises Plans According to Tactical Situation	Yes	VI	Breakthrough occurs.	Lack of warning orders and untimely FRAGOs unable to reposition units.
III308	G3: Maintains Updated Files on Personnel (from G1)	Yes	VII	Unit in contact is annihilated and overrun due to personnel shortages.	Request on personnel status on Command Net.
III309	G3: Maintains Updated Files on Intelligence Activities (from G2)	Yes	VII	"	
III310	G3: Maintains Updated Files on CSS Functions (from G4)	Yes	VII	Unit in contact is annihilated and overrun due to ammunition shortages.	
III402	G4: Maintains Current Status of POL Supplies	Yes	II	Units call for POL repeatedly.	Allocating POL to areas with less need.

TABLE E-1.   INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
III403	G4: Maintains Current Status of Ammunition Supplies	Yes	II	Must use tactical net to get ammunition.	Allocating ammunition to areas with less need.
III405	G4: Revises Projected CSS Requirements Based on Above Information	Yes	V	Ammunition low in key unit.	Intense combat operations do not elicit extra queries from G4.
III406	G4: Coordinates CSS Activities with DISCOM	Yes	X	POL or other supplies run out.	No action by DISCOM to help relieve CSS problems.
III602	FSCOORD Revises Counter-battery/Direct Fire Proportions as Needed	Yes	VIII	Unit being overrun does not receive artillery support.	No changes of DS, GS assignments.
III603	FSCOORD Revises/Updates Target List	Yes	X	Not Receiving pre-planned fire bonuses.	Additional plots of artillery kill zones are not made and coordinated.
III6C5	FSCOORD Monitors Ammunition Supply	Yes	II	Artillery runs out of ammunition.	
III701	ADE Revises AD Critical Areas	Yes	X	Critical areas are shifted without AD changes.	Reports of changes of position do not result in AD change.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
IV205	G2: Records Information	Yes	IX		Repeated requests received from G2 for similar information.
IV209	G2: Interprets Information to Produce Intelligence	Yes	X		When called for information G2 doesn't provide co herent picture.
IV213	G2: Disseminates Intelligence to G3	Yes	VII	Defense fails.	
IV101	G1: Monitors and Supervises Evacuation of NBC Casualties	Yes	VIII		
IV102	G1: Updates Personnel Situation Based on Effects of NBC Attack	Yes	II		
V203	G2: Collects NBC Reports	Yes	X		No query when reports not submitted.
V204	G2: Disseminates NBC Reports	Yes	VI		
V302	G3: Updates Operations Appraisal Based on NBC Effects	Yes	II	Units remain in fallout areas.	No changes in mission or responsibility.
V303	G3: Recommends Alternate Course of Action	Yes	VI		
V402	G4: Updates Logistics Appraisal	Yes	X	Contaminated equipment issued.	No FRAGO with new CSS section.

TABLE E-1. INITIAL ASSESSMENT OF SIMULATION SUITABILITY (Cont'd)

NR	CRITICAL ELEMENT (CE)	ACCOMMODATED WITHIN SIMULATION PLAY?	PPD*	BOARD INDICATOR	STAFF INDICATOR
V403	G4: Prepares Reallo-cation Plans	Yes	VII		No requests to higher hq.
VII	G1: Ensures Proper Medical Support is Provided	Yes	X	Additional medical support not provided to attack force.	
	G1: Ensures Adequate Personnel Replacement	Yes	VII	Units be-come inef-fective.	Inappropriate mission based on personnel situation.
	G3: Provides Changes to Task Organization, Troop Displacement and Tactical Plan to G4	Yes	VII	Running out of supplies when mission changes.	No communica-tions changing POL allocation.
	G4: Coordinates with Other Staff Sections and DISCOM	Yes	VII	Supplies delivered to wrong units.	

APPENDIX F
QUESTIONNAIRE SUMMARIES

CONTENTS

F-1

SUMMARY
USER QUESTIONNAIRE

BACKGROUND:

1.   What is your rnak and branch of service?

Response: 1LT-MAJ, mostly combat arms.*

SAI Comment: Tactical Training of company gade officers seems to be
               emphasis of division.

2.   With which U.S. Army simulatioins are you familiar?

Response: DUNN KEMPF, CAMMS, CATTS

SAI Comment: This reflects the geographic closeness of post 1 to Fort
               Leavenworth and the tactical emphasis of the division.
               Note omission of PEGASUS, the standard TRADOC simulation
               for brigade/battalion.

3.   In how many separate exercises employing army simulations have
        you participated? (In what roles?)

Response: 4-7; all as player-controllers.

SAI Comment: This indicates division-wide acceptance of the simulation
               medium.

4.   How many different commercial wargames have you played? Were
        they historical or contemporary?

Response: None. (one exception)

SAI Comment: Important in view of overall acceptance of wargaming.

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*   (Sample: 2 + informal interview w/4 Captains; 1 questionnaire left
    for MAJ Bartley.)

GENERIC SIMULATIONS:

5.   Do you find simulations Useful for training? If so, how?

Response: Mostly tactical training is accomplished.

SAI Comment: See #1

6.   Have you used the ARTEP process and task lists in conjunction
        with simulations? If so, how?

Response: Not really.

SAI Comment: Probably somewhat reflects ranks of interviewees.

7.   How would you use the simulations to help you conduct ARTEP
        training?

Response: No answers.

SAI Comment: Reflects vacuum that ARI study should fill (but at
              command/staff level).

8.   What methods have you used for assessing training results? Are
        they effective? If not, why? What feedback mechanism do you
        use?

Response: BMTS and post-exercise critique, informal note-taking.

SAI Comment: Individual initiative guides this informal briefing
              technique. BMTS is the Battalion Management Training
              System, an Infantry School publication, according to an
              interviewee.

9.   What constraints (or burdens) do you find troublesome (admin-
        istrative and other)?

Response: None surfaced.

SAI Comment: This might reflect the ease of use of the simulation
              medium, the enthusiasm and professionalism of the player
              controllers, or the ranks of the interviewees who are not
              as concerned with resource problems.

SIMULATION SPECIFIC QUESTIONS:

10.   How difficult were the simulations to learn?

Response: Most felt they were easy.

SAI Comment: Learning them was considered easy, yet playing some (CAMMs) in real time was difficult. CBQ was designed by the First Division to simplify play by obviating the requirement for player controllers to learn game rules (i.e., outcome calculated by computer). This is a significant point.

11.   Are the combat results believable? If not, why?

Response: Yes

SAI Comment: No perceived combat results disparity was voiced. This could be dangerous since modified, unclassified data base was used.

12.   What local modifications have been made? Why?

Response: CBQ is a computerization of DUNN KEMPF.

SAI Comment: An APPLE II Plus w/48K memory and two fice inch floppy disks, PASCAL language card, high resolution graphics. The CRT is essentially computerized with modifications based on posture (combat multipliers).

13.   What modifications do you think should be made?

Response: Not addressed, except CAMMS combat multipliers.

SAI Comment: Overall CAMMs does not have a good reputation in the 1st Division, due principally to the perception that BLUE always loses regardless of how well its forces are handled. This can erode training value. Its acceptability was said to go "in cycles" in that, after a frustrating play, time passes and it is again perceived as necessary for C^2 training.

14.   Are you using any simulations other than those provided by TRADOC? Which ones? Why?

Response: CBQ

SAI Comment: MAJ X, CPT Y, and 1LT Z have designed and implemented CBQ. See #10, above.

SCENARIO SPECIFIC QUESTIONS:

15.   Are the scenarios consistent with your understanding of the threat: If not, why?

Response: Yes

SAI Comment: Apparently most OPFOR controllers pride themselves on their ability to emulate the OPFOR tactics. This must be carefully monitored.

16.   How important are good OPORDs to the development and play of the scenarios?

Response: Not important if time isn't a factor, i.e., constrained. Otherwise, painful execution results.

SAI Comment: Excessive radio traffic is probably an indicator of less than adequate OPORDs. Response also indicates tactical rather than C^2 orientation of interviewees.

17.   Do you have enough tactical latitude to fight the engagement your way during simulation play? If not, why?

Response: Yes, except CAMMS.

SAI Comment: Again, CAMMS and its force ratio methodology receive bad ratings for allowing tactical flexibility.

OTHER COMMENTS:

Thank you for your time.

SUMMARY
CHIEF UMPIRE/SIMULATION CONTROLLER

DATE: 17 Aug 81

1.   What is your rank and branch of service?

        1LT - MAJ (Sample: 3)

2.   How many years have you used tactical simulations?

Response: About 2-3 years.

SAI Comment: Reflects relative newness of simulations.

3.   How would you rate the current generation of simulations with
        respect to playability, game components, acceptability, and
        amount of overhead required to conduct successful training?

Response: Good, except CAMMS

SAI Comment: The entire gamut of officers seem to be enjoying and using
              the simulations proviided (except for CAMMS).

4.   Do you encourage strict adherence to the rules or do you pre-
        fer that players resolve most disputes by mutual agreement?

Response: Mutual agreement seems preferable.

SAI Comment: The Free Kriegspiel concept that rules are never all
              inclusive seems to underly the view that agreements between
              player controllers are preferable.

5.   Comment on the adversarial nature of simulation play. It it
        indicative of player involvement?

Response: The adversarial nature indicates player involvement but it
              should be minimized.

SAI Comment: Good OPFOR player-controllers should realize that they are
              training aids. Blue controllers shouldn't get disturbed by
              the odds.

F-6

6.   How would you improve the simulations to aid commanders in
       training their units?

Response: Improve combat multiplier functions in a modular fashion.

SAI Comment: Again, the staff mode is neglected.

7.   Are tactical conclusions being drawn during play by many of the
       players? In your opinion is this appropriate?

Response: Yes. Yes.

SAI Comment: We need to determine whether this is appropriate, and to
              what degree.

8.   What methods have you observed for feedback of results to units
       being trained? Which seem too be successful? Why?

Response: Critique post-exercise. Most feel senior officers under-
              stand the essence of the scenario and play.

SAI Comment: The lack of formalism in the critique phase is not deemed
              as a weakness by controllers.

9.   Are you using any simulations other than those provided by
       TRADOC? Which ones? Why?

Response: CBQ

SAI Comment: Ostensibly to reward good battlefield tactics.

10.   How difficult are the simulations to learn (by yourself and
       by using unit personnel)?

Response: Easy

11.   Are tactical communications and tactical TOCs maintained during
       exercises? Are they beneficial?

Response: Yes, Yes, they are cost effective.

SAI Comment: Radio commo doesn't seem to be exercised and minimal
              staffing of CP was observed.

12.   Other comments:

Response: None.

                    Thank you for your time.

USER QUESTIONNAIRE
(SUMMARY)

DATE: 17-18 Sep

BACKGROUND:

1. What is your rank and branch of service?

    Average: Captain

    Exceptions: Division Commanding General, Assistant Division
                  Commander (Maneuver) and Battalion Commander.

    Comment: First opportunity to interview senior personnel. See
                  trip report for comments.

2. With which U.S. Army simulations are you familiar?

                  The entire CATRADA set.

    Comment: Rejuvenation of gaming in starting in Spring 1981.
                  Significant activity since and continuing.

3. In how many separate exercises employing Army simulations have you
   participated? (In what roles?)

    Average: 8 or more

    Comment: See No. 2. One unit is gaming a continuing exercise
                  with play once per month. This is unique so far. Same
                  unit interjects logistics play allowing more exercise
                  by virtue of the longer term tactical problem.

4. How many different commercial wargames have you played? Were they
   historical or contemporary?

                  Personnel interviewed at the CPT level had played more
                  than 20.

    Comment: Reflects interest of younger officers, but probably a
                  biased sample.

GENERIC SIMULATIONS:

5. Do you find simulations useful for training? If so, how?

> Yes
>
> a. Tactical execution and command/staff coordination.
> b. Free play exercises with minimal resources.
> c. Use of larger area than normally available for field training.
> d. Provides "big picture" and part each plays. (See also "other comments").

Comment: Items c. and d. not recorded at and are important points.

6. have you used the ARTEP process and task lists in conjunction with simulations? If so, how?

> As a checklist for both constructing scenarios and evaluating exercises.

Comment: Use as a guide for constructing a scenario deserves further attention (instructions?).

7. How would you use the simulations to help you conduct ARTEP training?

> a. Provide staff driver keyed to ARTEP tasks around which exercise was developed (see #6).
> b. Rehearse leaders and staffs.
> c. Maintain skills during periods when other unit tasks have priority.

Comment: Item c. is a useful point, given that unit recognizes the requirement (which may not always be the case)

8. What methods have you used for assessing training results? Are they effective? If not, why? What feedback mechanism do you use?

> Immediate verbal critique with players, controllers and Sim. Ctr. personnel participating. Noticeabley superior was a controller log which was synopsized at Exercise end. Written report by Sim. Ctr. to commander who requested the exercise.

Comment: See comments in body of trip report.

GENERIC SIMULATIONS (Continued)

9. What constraints (or burdens do you find troublesome (administrative and other)?

             a. Radio availability.
             b. Time. Goal is one PEGASUS and one DUNN-KEMPF per month plus one FIRST BATTLE with Division each quarter.

Comment: Item b. reflects an ambitious program of one unit. Not all this active.

SIMULATION SPECIFIC QUESTIONS:

10. How difficult were the simulations to learn?

        a. Not considered difficult.
        b. Instruction by Sim. Ctr. personnel considered
           useful.

Comment: A competent instructor cadre appears to be a very
           valuable asset. The degree to which this quality could
           be maintained in a decentralized mode (rather than at a
           Sim. Ctr.) deserves further attention.

11. Are the combat results believable? If not, why?

        Yes (universally among respondents) (with the exception
        of certain pairings -- see #13).

Comment: We must be careful here due to unclassified data base
           and lag in incorporating new systems.

12. What local modifications have been made? Why?

        Relatively few. First Battle terrain effects
        (observation and acquisition) modified to reflect thick
        foliage and reduced mobility in Florida.

Comment: Degree of non-standardization needs to be examined
           overall. Not a real problem at Post 2.

13. What modifications do you think should be made?

        Mostly tactical and related to combat multipliers.

Comment: Handling of helicopters and aircraft (spotting) seems
           to be an area of concern. No major desire for
           modifications overall, but lag of CRT's in relation to
           current threat is recognized.

14. Are you using any simulations other than those provided by TRADOC?
Which ones? Why?

        Occasionally tactical (Platoon/individual tank) games
        are used.

Comment: Reflects, but to a lesser degree, the small unit
           tactical training emphasis found at Post 1.

SCENARIO SPECIFIC QUESTIONS:

15. Are the scenarios consistent with your understanding of the threat? If not, why?

> Generally, yes.

Comment: Those who are aware of new threat equipment are dissatisified with available CRTs.

16. How important are good OPORDs to the development and play of the scenarios?

> Critical, especially in a realistic "limited intelligence" simulation.

Comment: Importance emphasized in terms of keeping player-controller from straying from the purpose of the exercise. New point: Provide method for observing how subordinates implement guidance and orders (feedback on clarity and comprehension level).

17. Do you have enough tactical latitude to fight the engagement your way during simulation play? If not, why?

> Old CRT's prevent using new equipment. Otherwise adequate.

Comment: We need to examine ways to update game materials (e.g., loose leaf binder, replacement pages).

OTHER COMMENTS:

> a. Allows leaders to get to know and understand each other in a tactical context.
> b. Allows leaders to observe how other units operate and compare tactical methods.

Comment: This group was enthused about the benefits of simulations. Items a. and b. are important.

Thank you for your time.

CHIEF UMPIRE/SIMULATION CONTROLLER

DATE: 18 OCT 81

1. What is your rank and branch of service?

    Captain (Promotable), Infantry

2. How many years have you used tactical simulations?

    21 Years

3. How would you rate the current generation of simulations with respect to playability, game components, acceptability, and amount of overhead required to conduct successful training?

    DUNN KEMPF: I consider this to be the most useful and playable of all available simulations. The only drawback I can find to this game is its size. A table top version similar to the commercial SPI game "Fire Fight" would be useful for field use as well as garrison.

    PEGASUS: Another excellent simulation which only needs to be updated. Combat Results Tables need to take into account the Soviet T-72 Main Battle Tank. DesertM aps and rules need to be developed while not deleting the current European Scenario. Playing pieces are generally of the highest standards but plastic unit counters would be useful. Overhead is high but everyone is learning as long as units use the actual personnel responsible for various actions in player/controller roles.

    FIRST BATTLE: This game has outlived its usefulness. Division commanders now want to use it to train staffs throughout the division chain, down to and including company, in a CPX mode. This is due to two things: (1) Senior commanders are more familiar with gaming potentials than in the past. (2) With the personnel overhead so high, it is more practical to train the whole group. This game just was not designed for such extensive modification and does not provide the high resolution required at lower levels. General officers are now looking for a division level PEGASUS.

4. Do you encourage strict adherence to the rules or do you prefer that players resolve most disputes by mutual agreement?

I have worked both ways. If the game is small and not restricted by timed game turns it increases player enthusiasm and cooperation to allow them to work out problems on their own, only getting involved to settle disputes which they are unable to reach agreement on. However if the game is large, complex and envolving more than 6 to 8 players it is imparative that all players be tightly controlled and all operating from the same set of rules. Otherwise total chaos will result and the loss of respect for the umpire will be unrepairable.

5. Comment on the adversarial nature of simulation play. Is it indicative of player involvement?

As long as the players understand their role and what the training objectives are I have never experienced anything but the highest levels of professionalism and concern that the player is accomplishing his mission. Cooperation between opposing teams is good and the end result outstanding. With this understanding the battle does not beomce personalized on the board.

6. How would you improve the simulations to aid commanders in training their units?

All the simulations currently available are excellent if used exclusively for what they were designed for. The main problem is that each commander/user has his own set of training goals or objectives and these just flat do not always lend themselves to the designer's intentions. We presently have a large inventory of games designed for many uses. Yet I am always having to modify them for various exercises they were not initially designed for. Sometimes this is simple and sometimes very complex. As more and more games appear, all with their own separate sets of rules, it becomes more and more difficult for the users to learn how to play them all and to determine which one to use. What we really need now that we have so much experience in this field is not more games but one all con- suming monster game. It should start at company level and be capable of growing up to division by the use of add-on packages. It should be computerized with computers actually based on the users installation. The latest mini computers, i.e., TSR 80 Module II or APPLE, lend themselves ideally to this situation. This woulld give the user the capability to modify programs if they do not suit his needs. I realize that what I have said will cause some to laugh and an R&D man to have a heart attack, but just you try to teach a company commander to play DUNN KUMPF, PEGASUS, FIRST BATTLE, CAMMS I and II, BLOCK BUSTER, BATTALION STAFF, ARTBASS-M, WAR EAGLE and whatever else you have planned to come down the road. This man's time is valuable and he doesn't hae much of it left.

7. Are tactical conclusions being drawn during play by many of the players? In your opinion is this appropriate?

Your right they are and it doesn't matter if you feel it is appropriate or not, they are going to do it. It is a military man's nature to project himself into that map or playing board and try to picture what it will be like in various situations. If he then makes a decision to execute a specific tactical maneuver or use a specific weapons system and then is unsuccessful in defeating his enemy, he will not do the same thing again in the game or the field. Conversely, if successful, he will use it again in the future if a similar situation arises. He is learning tactics, testing doctrine, and experimenting with his own tactical philosophy and concepts. He believes that the combat results table reflects a great deal of research and therefore real world probabilities and outcomes. He learns to make decisions based on the odds and will remember the results of this actions.

8. What methods have you observed for feedback of results to units being trained? Which seem to be successful? Why?

Immediate via tactical radio or wire, written after action reports, and both formal and informal conferences immediately after the exercise.

   a. Radio/Wire: This is excellent for critical moments in the battle as long as the player is experienced in gaming and tactics and has the ability to convert game information into tactical language prior to engaging his mouth. Unfortunately most players seem to have great difficulty doing this.
   b. Written: Provides a good record but is seldom acted on or disseminated to lower echelons than commander.
   c. Conference: Formal critiques are satisfactory for higher echelons as long as the player briefing is a fairly senior officer and has been given time to debrief each individual player. Much of the micro management type information that needs to be passed on to lower level staff officers is lost or ignored. My experience has shown that an informal sit down and talk it through session is the most informative and acted upon method. It is imparative that every player and exercised staff section be represented in total. It is also important that the commander not stifle a relaxed dialog. Since many junior enlisted men and officers will be briefing I find it best to start the briefing with a general outline of the briefing by the umpire, followed by the opposing force players, then begin working down the exercised echelons chain. This gives the junior members time to think out what they are going to say and to see that the commander is not going to eat them alive. Using this method has proved very effective and has met with outstanding two way communications.

9. Are you using any simulations other than those provided by TRADOC? Which ones? Why?

   We are looking into this possibility as such a wide range of needs are being identified, i.e., small squad level games that do not take up as much r⌐⌐m as DUNN KEMPF, improving on engineer play.

10. How difficult are the simulations to learn (by yourself and by using unit personnel)?

    I have found that the civilian gaming industry does a much better job of writing instructions and rules than does the military. If it had not been for my back ground in gaming I do not believe I would understand FIRST BATTLE rules today. As for training others, classes are very effective if taught by an experienced player.

11. Are tactical communications and tactical TOCs maintained during exercises? Are they beneficial?

    Yes they are. I do not feel they are absolutely necessary but do serve as a useful work out for the total TOC operation.

12. Other Comments:

Thank you for your time.

APPENDIX G

TRAINING WITH SIMULATIONS
(Command Group Training Packet)

GENERAL CONTENT

A.1 INTRODUCTION

A.1.1 <u>Purpose and Scope</u>

Provides training guidance for units that is both specific to and cuts across the family of extant simulations. Addresses battalion through corps. Emphasis on command/control training (commanders and staffs) but recognizes other uses of simulations. Suggests areas for automation as an assistance in using simulations. Objective is to provide guidance for use of extant simulations in an integrated fashion to achieve maximum training benefit for resources expended.

A.1.2 <u>Organization of this Document</u>

- Management of training
- Planning for training
- Conducting training

Document (training packet) organized to recognize "training system" approach, to include assessment of training situation and environment, establishment of objectives, relating objectives to simulation capabilities and limitations and "closing the training loop" by identifying remedial training requirements.

A.2 MANAGEMENT OF TRAINING WITH SIMULATIONS

A.2.1 <u>General</u>

- Assessing the training situation

Recognize nature of unit/individual to trained and the environment within which the training is to be conducted. Consider differing requirements for unit (active or reserve), institution, transition or refresher, individual versus group (collective) training.

- Benefits/burdens

Availability of time, facilities and personnel. Assessment of feasibility of meeting training objectives within given constraints. Nominal costs of simulation usage.

A.2.2 **Integratioin into a**
Training Program

- Long-range objectives   Mission and unit status consideracions.
Training cycle and special mission
requirements (e.g., REFORGER and con-
tingency force participation). Simula-
tion applicability and availability of
scenarios.

- Other forms of   Integration with CPXs, FTXs and other
exercises   types. General approach and samples of
how simulations can be employed.

A.2.3 **Centralized Versus**
Decentralized Simula-
tion Operations

- Personnel, facil-   Post-level orientation (e.g., division
ities, costs   control vs brigade); use of Simulation
Center concept. Nominal organization
of Simulation Center. Training and
evaluation potential. Benefits and
burdens of decentralized simulation
usage.

- Impact on standardi-   Doctrinal implications of rules vari-
zation of training   ations and interpretations, OPFOR
tactical employment and local simu-
lation modifications. (Configuration
control)

A.2.4 **The Future of Simula-**   General capabilities and limitations of
tions   each type. Appropriate projections
from TRADOC programs/plans. Potential
- Manual   for developing computer assistance at
post/unit level.

- Computer assisted

- Computer driven

A.2.5 **Other Uses of Simula-**   Capabilities and limitations. National
tions   Training Center implications. Criteria
for simulation selection. Implications
- SOP validation   of centralized vs decentralized con-
trol. Classification/security implica-
- OPLAN validation   tions and cautions.

- Tactical/doctrinal
experimentation

- OPFOR tactics

- Tactical Training

- Weapon system capabilities and employment

A.2.6 **Gaining Acceptance**   Advantages and disadvantages of simulations. Training of all personnel
- Simulations vs   involved. Efficient use of time. Im-
  Master Incident   portance of understanding of objectives
  Lists (MIL)   (see also A.3, below). Relationship to
                                                 ARTEPs in both training and evaluation
- Training vs Evalu-   context.
  ation

  -- ARTEP context

  -- Training tool

A.3 PLANNING FOR TRAINING WITH SIMULATIONS

A.3.1 **Development of Training Objectives**

- General formulation   Extension of Sections A.2.1 and A.2.2,
                                                 above. Determination of level to be
                                                 trained (individual, staff element,
                                                 unit staff, etc.), and type of oper-
                                                 ation (offense, defense). Pre-
                                                 simulation training.

- Philosophy of simu-   Applicability of simulations vs other
  lations   methods (e.g., MIL). Advantages and
                                                 disadvantages of introducing time
  -- c^2 dimension and battle dynamics given
                                                 "going-in" state of training.
  -- Other uses

- Staff responsibil-   Applicability and use of FM 101-5.
  ities and functions   (See also Section 3 of Technical Report
                                                 (in part)).

- ARTEP   Use of ARTEP during preparation for and
                                                 employment of simulations. (See also
  -- Tasks and stan-   Section 3 of Technical Report (in
     dard   part)).

- Specific training needs	Requirement for clear articulation of exercise objectives as they relate to needs. Selection of appropriate feedback mechanism.

A.3.2   Simulation Suitability

- Simulation hierarchy	Definition of simulation hierarchy to include general assessment of complexity, difficulty, realism, and feedback potential.
- Extant simulations and training objectives and needs	Detail to be provided in appendices (to CGTP). Documentation availability and completeness. Caustions as appropriate. Scenario applicability and availability, both broad (e.g., Middle East) and narrow (functional, e.g., a river crossing).
- Simulation employment methods	Strategies for employment of simulations: single, combinations, modules, computer assistance.
- Selection criteria	Scope, time available and required, personnel, facilities, costs.
- Modification potential and procedures	Data base considerations; cautions (see A.2.5, above). Appropriate procedures for modifying simulations where needed to meet specific needs.

A.3.3   Implementation Guidance

- General	Specification of objectives.
- Player objectives and participation	Pre-execution activities.
- Player-controller responsibilities and training (including OPFOR)	Pre-execution training (controllers and evaluators). Methods and time required.
- Data collection and reduction	Method(s) to be used: logs, journals, player-controller notes, other.
- Conducting exercises with simulations	Simulation Center and/or unit procedures. Use of cues and probes.

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**A.4 IDENTIFICATION OF TRAINING
REQUIREMENTS**

    **A.4.1 Evaluation and Critique
           Techniques**

Feedback mechanisms. Requirement to
specify in detail prior to start of
exercise.

    A.4.2 Diagnostics

Guidelines for identification of staff
performance deficiencies and culpable
staff members. Distinction between
data processing and cognitive errors.
Entails such issues as promulgation
of specific standards and methods or
measurement.

    **A.4.3 Indicated Training
           Requirements**

Functional, sustainment, remedial.

    A.4.4 Restarting the Cycle

"Closing the training loop." Simula-
tion suitability and selection criteria
for training requirements identified.
Pre-simulation training where indicated.